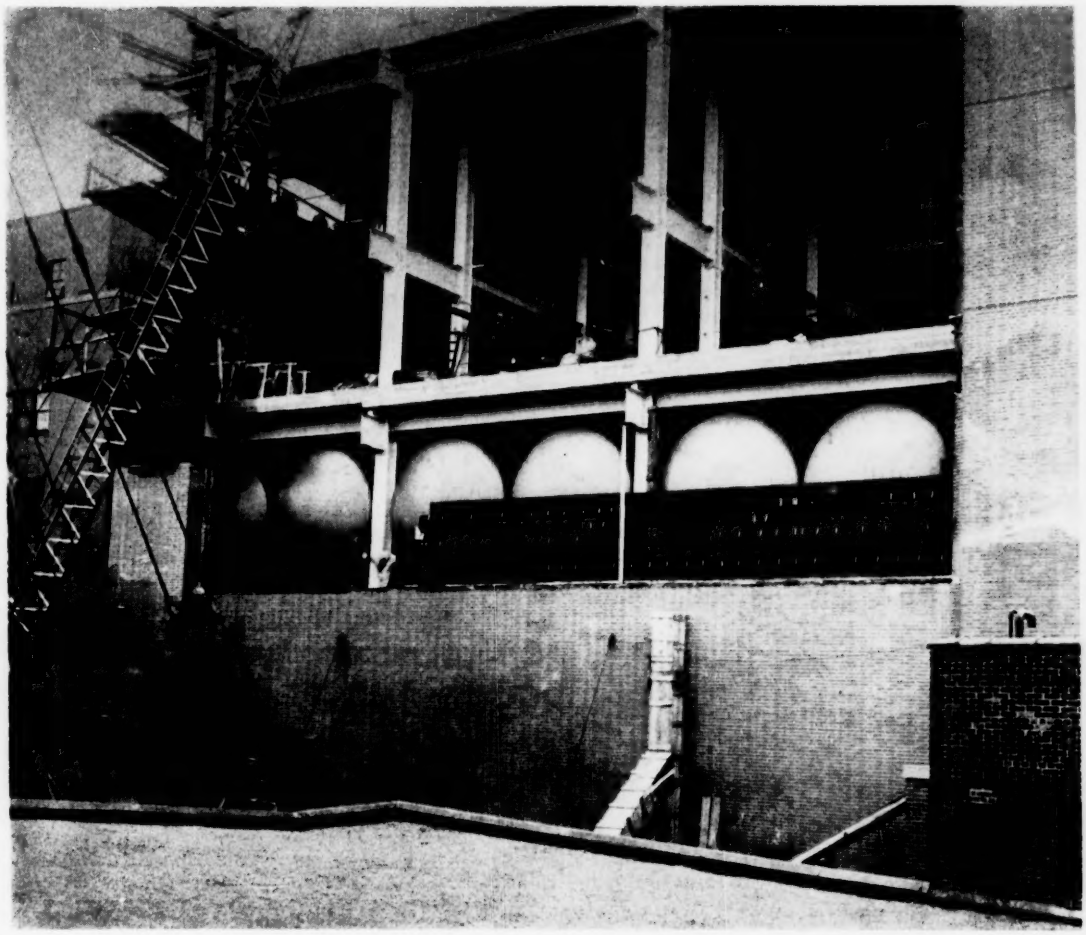
INDUSTRIAL REFRIGERATION

April, 1958

Vol. 134 No. 4



COVER — Tight Squeeze for Insulation

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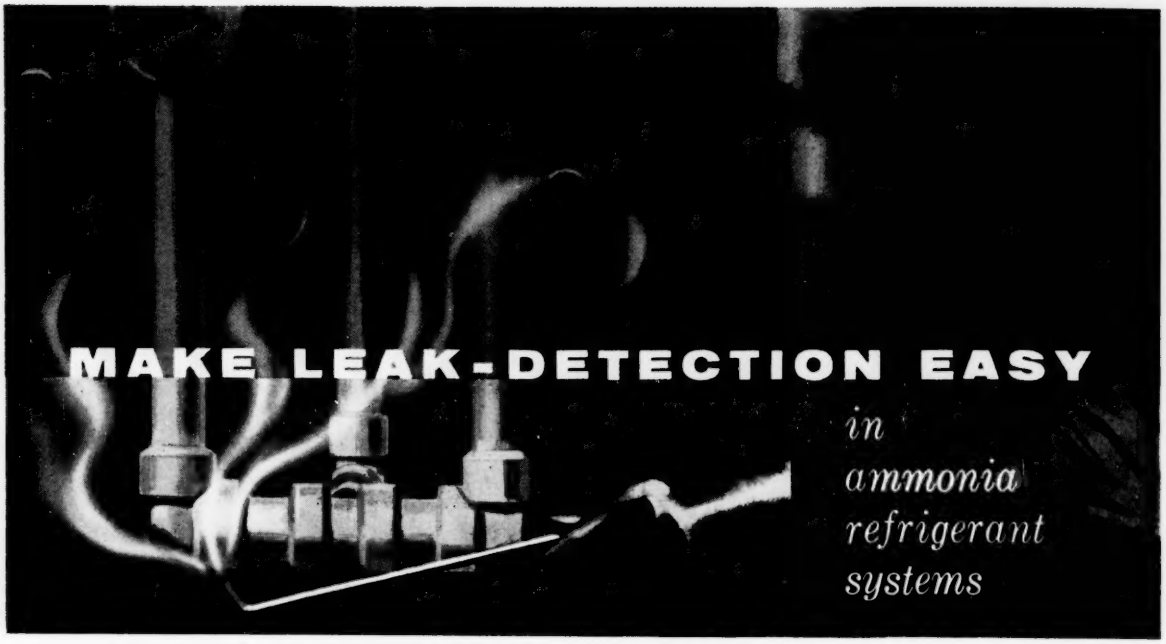

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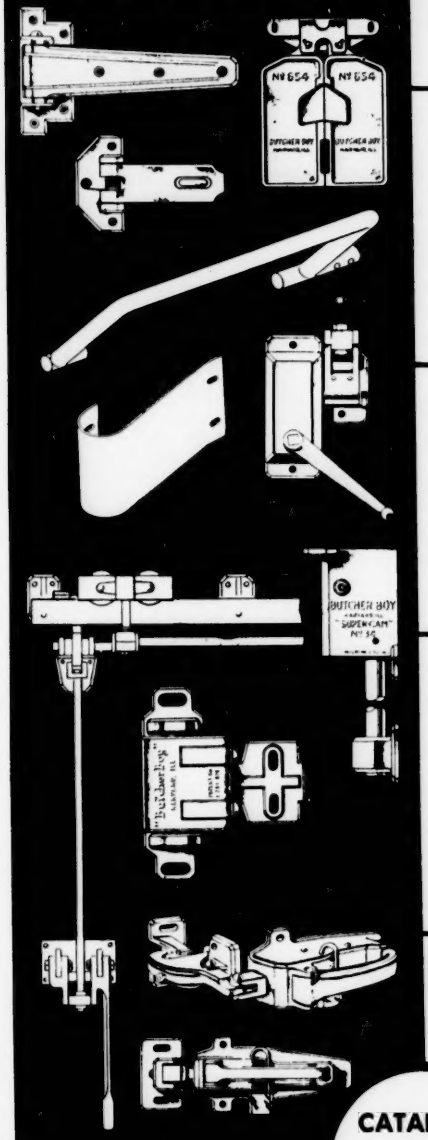
"Butcher Boy" Since 1885

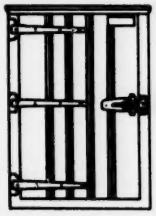
Refrigerator Doors

REFRIGERATOR DOOR HARDWARE



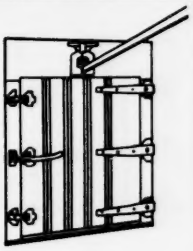
SAFETY RELEASE FASTENERS
No. 11 or No. 12
Permit opening from within even though padlocked from outside

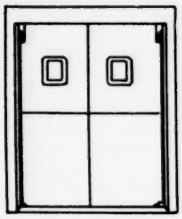
CATALOGS AVAILABLE UPON REQUEST



STANDARD COOLER-FREEZER DOORS

- Modern Streamlined Appearance
- 100% Douglas Fir Construction
- Massive and Durable Hardware



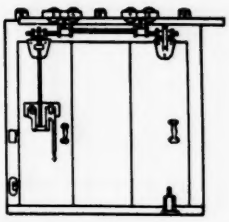


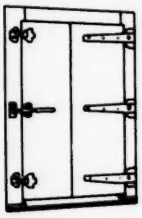
STANDARD VESTIBULE AND AUTO CLOSE DOORS

- Double Acting Doors for Loading Docks
- For Heavy Trucking Openings
- Save Refrigeration Losses

HORIZONTAL SLIDING DOORS

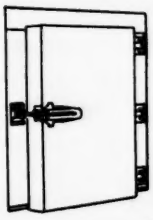
- Ideal where space factor is limited
- Recommended for Freezer Areas
- Available for manual, air, or electric operation
- Mechanically operated doors open and close in less than 4 seconds





LOW TEMPERATURE INFITTING AND SUPER FREEZER OVERLAP DOORS

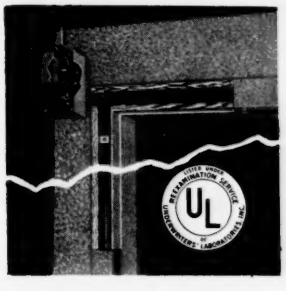
- Low Temperature Doors for +10 to —20° F
- Super Freezer Doors for —0 to —100° F
- Both types available with No. 51 electric defrosters
- Extra heavy duty hardware applications



New!

FULLY AUTOMATIC ELECTRIC DEFROSTERS

- Underwriter's Approved—An exclusive First with Butcher Boy
- Flexible "silicon" covered (not lead covered) heater cables
- Furnished with calibrated "thermostat"—economical heat control



BUTCHER BOY REFRIGERATOR DOOR CO. Dept. "MG" HARVARD, ILLINOIS

HAVING FLOODED SYSTEM PROBLEMS?

Master them with SPORLAN PEAK PERFORMANCE LEVEL-MASTER CONTROL

LMC

LEVEL MASTER CONTROL

The LMC consists of a standard Sporlan thermostatic expansion valve with a Level Master element and an insert bulb containing a low wattage heater. This perfect combination assures a positive liquid level control for all flooded systems.

The LMC feeds with a modulated flow, not an ON or OFF action. It is not affected by turbulence or agitation that might occur in the low side. Its effects are that of striking and maintaining a constant liquid level.

The insert bulb controlling the liquid level has no moving parts . . . it is not a mechanical float device.

The insert bulb can be easily and economically installed directly in the shell, accumulator or liquid leg for direct contact with the refrigerant on either new or conversion installations . . . no need for special balance line piping.

Get Peak Performance with the Sporlan LMC on all flooded systems using Refrigerants 12, 22, 500, or 717, whether they are Sharp Freezers . . . Hardening Rooms . . . Brine Chillers . . . Continuous Freezers . . . Milk Storage Vaults . . . Bottling Machines or Cold Storage Warehouses.

MADE FOR VALVE TYPES P-H-M-V-W-D-A

For complete details on the Sporlan LMC, ask your Sporlan Wholesaler for Bulletin 60-15.

SPORLAN VALVE COMPANY
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April, 1958

Number 4

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A control repair in the drive rod mechanisms of the reactor at the Argonne Laboratories was effectively accomplished with a minimum delay using dry ice and alcohol to provide an "ice dam" to prevent the release of radioactive water.

Automatic Operation of Centrifugal Compressors . . **12**

Visualize construction expenses of a plant erected in 1956, actually being less per ton of production than a plant constructed five years earlier. Basic considerations behind such a project are outlined; to be followed with a detailed story.

The Refrigeration Research Foundation **18**

A record meeting of the Foundation heard food conservation experts discuss the continuing progress being reported in many research projects, especially in the "Time-Temperature-Tolerance" studies of frozen foods.

Water Conservation Equipment **23**

The theory and application of water saving devices compares the advantages and disadvantages of the various types of equipment available for this important refrigeration system component.

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The Cover:

Engineering for industrial refrigeration projects often times involves more than thermodynamic considerations. In December 1956 when the F. & M. Schaefer Brewing Company decided to add three floors to Stockhouse "F" in their Brooklyn, New York plant they ran across a situation requiring a little structural knowledge.

Because of the narrow space between beer aging tanks and the masonry wall of the building, insulation of the tank room would have been nigh onto impossible after the walls were erected. The problem was solved by erecting a self-supporting insulation wall of two layers of 2-inch foam glass blocks before the outer wall was completed. Brick was secured to the cellular insulation by means of the customary metal bonding ties. One of the reasons the third floor aging house was finished three weeks ahead of schedule, is attributed to this unique construction.

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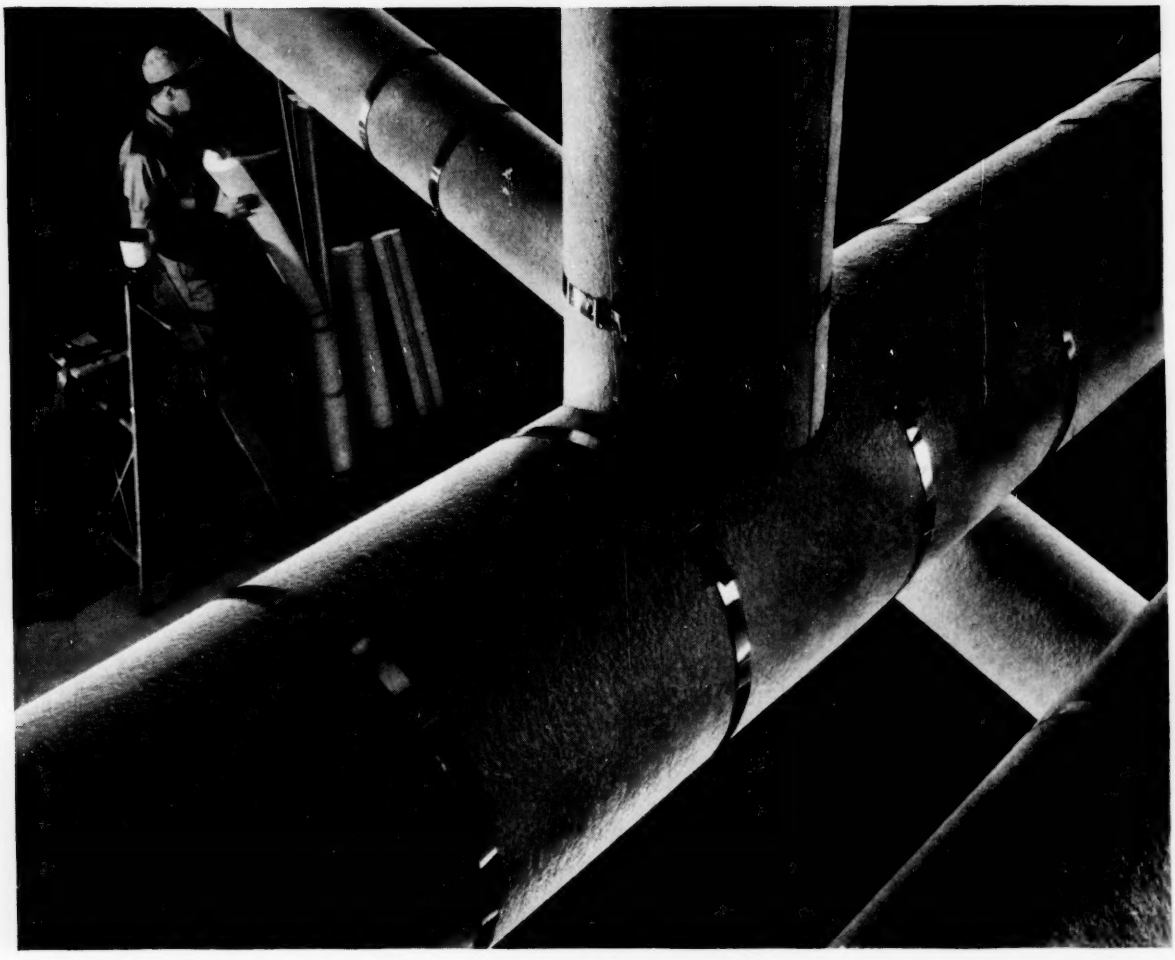
General Offices: 433 N. Waller Ave., Chicago 44, Ill. Telephones: AUstin 7-1303-04-05



Styrofoam® stops moisture, repels heat

Superior properties make Styrofoam an outstanding low-temperature pipe covering

There are just three things most people ask of a low-temperature pipe insulation. That it . . .

(1) Stop costly heat gain. (2) Prevent condensation and dripping. (3) Stay trim and effective without maintenance.

Pipe covering made of Styrofoam* does an outstanding job all three ways, and at surprisingly low applied cost. The reasons are the low thermal conductivity of Styrofoam ("K" factor: 0.23-0.27) and its unyielding resistance to liquids and water vapor. (This is the same Styrofoam that has been so widely adopted as a low-temperature room insulation during the last 10 years.)

Styrofoam is an effective vapor seal, and will not crack or split in extremely cold or rapidly changing temperatures. It is not subject to ice build-up around valves. And Styrofoam is lightweight—easy and economical to apply. Coatings for both indoor and outdoor use are available and easily applied in the field.

The companies listed below manufacture a complete line of pipe covering made from Styrofoam, as well as a wide variety of equipment and tank insulating segments. See them about your low-temperature pipe covering problems. Or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 1903C.

STYROFOAM Pipe Covering Manufacturers

Fastab Insulation, Inc., 304 Cleveland Transit Building, Cleveland 14, Ohio • Fibrous Glass Products, Inc., Alpa Plaza, Hicksville, L. I., New York • Glo-Brite, 6415 North California Avenue, Chicago, Illinois • Kennedy Industries, 4447 Alger Street, Los Angeles, California • Kransco Manufacturing Company, 503 Railroad Ave., South San Francisco, California • MMM, Incorporated, P. O. Box 968, Portsmouth, Ohio • Robinson Industries, 3051 Curtice Road, Coleman, Michigan • Styro Fabricators, 1401 Fairfax Trafficway, Kansas City, Kansas • Styroformics, Inc., 17 Hawkins Street, Somerville, Mass. • Tufflite, Inc., Ballston Spa, New York

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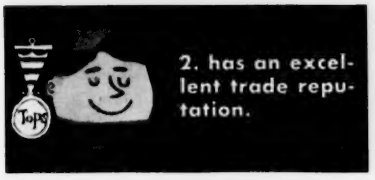
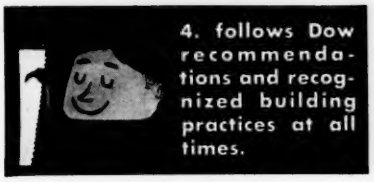
YOU CAN DEPEND ON DOW

Sign of an outstanding insulation contractor

Look for this seal when you build cold storage facilities. It's your assurance that the firm displaying it is competent and fully qualified to install Styrofoam*. This seal means the contractor . . .





For the names of Approved STYROFOAM Insulation Contractors in your area, write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1903C.

STYROFOAM

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DOW

What's New

MACHINERY
APPLIANCES • PROCESSES

Plastic Resin For Floor and Wall Repairs

A PURE plastic resin Amazite, recently announced by Hallemite Manufacturing Co. Cleveland, Ohio, may be applied over new or old concrete, terrazzo, brick, stone, marble, plaster, metal or wood to provide both complete protection against destructive acids and caustics, as well as resistance to abrasion. Thick applications may be trowelled on to transform rough, pitted floors into smooth traffic areas. Surfaces in good condition may be protected and preserved by brushing on the treatment like a paint.

Amazite hardens overnight into a dense, dustless, film that does not chip even when "feathered". Depending upon his own choice, the user can produce a finish either as glossy as a china plate or completely skidproof. Three formulations—for trowel, paint brush or spray gun application—are available in clear (amber), tile red and cement gray colors.

Phenolic Foam Insulation

PHENOLIC foam insulation, made by the Bakelite Company Division of Union Carbide Corp. was demonstrated at the Research Home program of the National Association of Home Builders. Actual installation of this plastic foam at the NAHB's Research Home located in Kensington, Md., was made several months ago. Ten cubic feet of foam were used to adequately insulate a sewer pipe, water service pipe, and electrical inlet. Of this volume, about 55 percent of the foam is under the ground and extends below the frost level. It is suitably protected from excess ground moisure by a vinyl film used to line the hole.

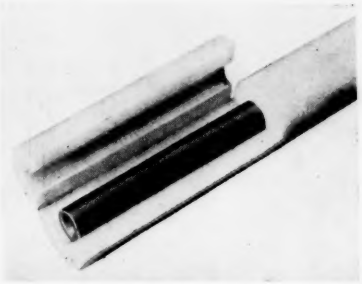
The ability of this phenolic formulation to foam at the relatively low temperature of 65 deg. F. enhances its possibilities as a modern insulating material. Low thermal conductivity, fire resistance, and economic foam-in-place manufacture represent advantages also of considerable importance to home builders. Current evaluation of these projects indicates entirely satisfactory performance of phenolic foam as a thermal insulation. A further development project actively in progress incorporates the use of Bakelite phenolic foam as an integral part of pre-fabricated wall structures.

Selby, Battersby Develops Coating for Insulation

KOLDROK protective coating for low-temperature insulating materials used in refrigerated rooms, was marketed by Selby, Battersby & Co., Philadelphia, last Fall. This new formulation, available in six colors, provides a smooth, rock-hard surface, improves sanitation and appearance, is in itself fireproof. An all-mineral compound, it is claimed to withstand temperatures from minus 50 F to 150 F without cracking. Koldrok is trowel-applied in one, lightweight coat.

Low Temperature Pipe Covering

LOW TEMPERATURE pipe covering with exclusive patented pre-adhesive edges is claimed to cut application time and costs by 40 to 50 percent on large or small piping. This pipe insulation is announced by the Glo-Brite Products Company of Chicago, fabricators of Styrofoam, a Dow plastic foam. Glo-Brite covering of Styrofoam is available in an extensive range of diameters suitable for virtually every domestic and industrial application in the low temperature pipe covering, providing not only insulation but also complete vapor barrier.



Low-temperature pipe covering with pre-adhesive seams and joints

Unique tooling and production methods, combined with the pre-adhesive edges, make available a combination of features heretofore unavailable in other materials. It is described as not only lightweight, but also rot-proof, mold-proof, water-proof, has no odor, and requires no covering or bands. A price list and schedule of pipe covering sizes is available.

Tube Coating Oils

PRACTICAL engineers, plant managers, buyers and others involved with the procurement, storage and fabrication of seamless and welded tubing, will wish to receive the concise information on protective coatings furnished by the Babcock & Wilcox Co. 3-page bulletin ERW-TSL No. 3. It describes in detail the various protective coatings and indicates the conditions under which such coatings will supply the required protection. Copies may be obtained without charge at the company sales office, Beaver Falls, Pa.

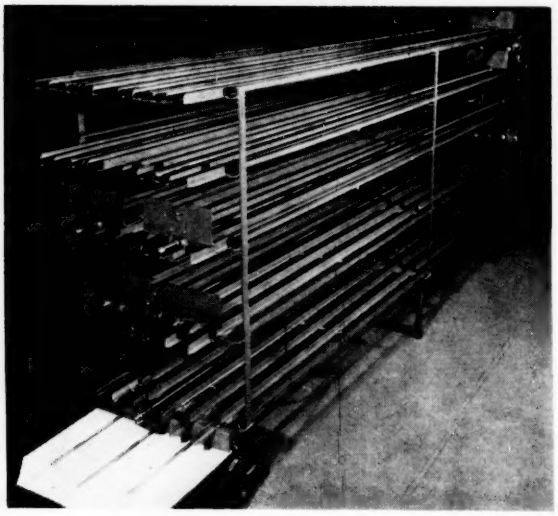
Recold Announces Air Handling Units For High Velocity Systems

IN order to meet the demand for air-handling Units to be used in high velocity systems, the Recold Corporation has announced that it can furnish its vertical, horizontal and multi-zone units for these applications.

Special wheels, which are available as additions to the Recold "Standard" product, are Class I—forward curved wheels, to handle applications up to 3½ in. of static pressure; and a backward curved wheel for applications up to 6 inches of static pressure. The addition of these wheels, with slight unit modification, means that Recold has a unit available for every type of system. The range of sizes is from 2350 cfm to 29,000 cfm.

Recold's heavy duty construction of angle iron frame, quality coil performance, and rugged casing makes an excellent unit for high velocity systems, according to the manufacturers.

New air handling unit introduced by Recold Corp.



New Multiple Ice Vendor

A NEW multi-screw vendor added to the K. G. Brown Mfg. Co. Inc., line uses a positive acting pusher plate on each individual line of packages, giving accurate single line vending regardless of the type of bag, package or block. An increase of 40 percent vending capacity is claimed for this new Long Island, N. Y., built vendor, due to the fact that bags or blocks are placed on the machine on edge instead of flatwise as on the alternate rail vendor. Rails have been added to give more support to the bags being vended which in turn offers complete circulation of air around each individual package. Made in longer lengths which provides a vending capacity of 450 10-lb bags in five tiers or a capacity of 270 10-lb bags on the three upper tiers along with 134 25-lb blocks on the two lower tiers, all vending is out of the same vending door. The standard width of these vendors is 30 inches allowing 10 rows of merchandise. Other widths are available.

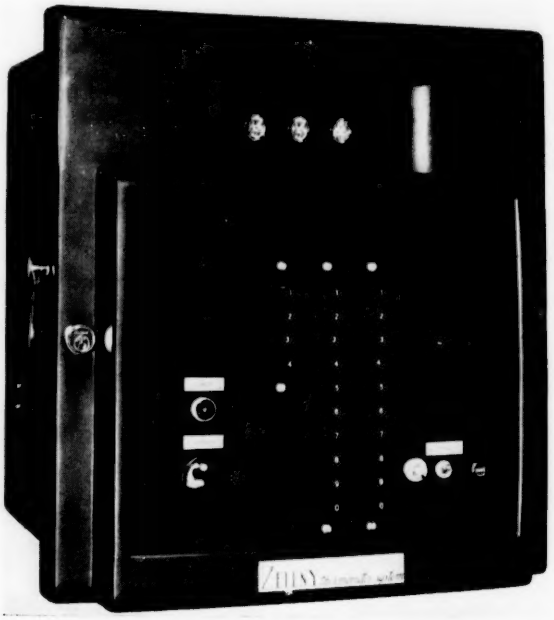
New ice vending tiers of multiple ice vendor introduced by K. G. Brown Manufacturing Co.

Electronic Device Aids Temperature Control

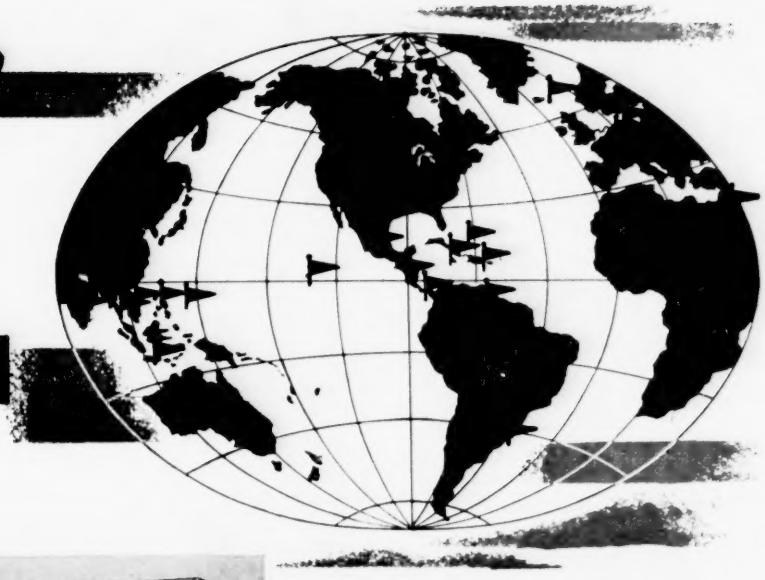
THE development of a new and completely electronic centralized temperature system for meat packers and cold storage plants is announced by Zeleny Industrial Systems Inc., Des Moines, Iowa. This system was designed and engineered to meet the requirements for monitoring temperatures in meat packing and cold storage plants. Fundamentally, this all new electronic system is designed to cut labor costs and at the same time provide more complete and accurate information on storage conditions.

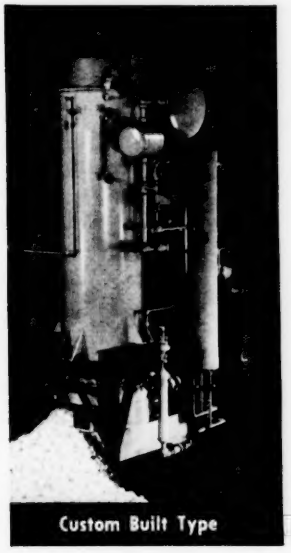
The company points out that in recent tests made, centralized temperature systems can reduce labor and pay for themselves in one year. Plants already equipped with the Zeleny systems have estimated savings of up to 50 percent on labor alone. The systems vary in size from as few as twenty temperature points to as many as 15,000 temperature check points. The system's controls can be operated either by manual selection and reading or remote control automatic scanning digital recorder.

Control board for Zeleny centralized temperature system.



Tube-Ice known the wide-world over!





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- **Guaranteed exceptionally low moisture content.**
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news briefs of the month

Radiation Limitation In Food Field Cited

Years of research before food will be preserved by irradiation on a commercial scale, and the process assume importance in our daily diet and nutrition, are foreseen by Dr. Zoltan Kertesz, chemist at New York State Agricultural Experiment Station. Dr. Kertesz made his assertion in a release to the daily press on March 8 in connection with the announcement of a new Food Science Building for the Experiment Station. One unusual feature of the new building will be an underground irradiation room in which to conduct research on food preservation using cobalt-60 as a source.

Refrigeration Helps Track Satellites

Two industrial air conditioning systems are required in each of 28 tracking stations which operate beneath the earth circling orbit of America's Vanguard satellite. One system is used to handle the tremendous heat produced by electronic equipment and nearly 1,000 vacuum tubes housed in each tracking station. The second air conditioning system produces constant temperatures in operational areas within the station, enabling sensitive equipment to be exact in their readings.

Portland Oregon Firm Expands Freezer

Ground was broken early in March for a 50 x 100 ft. addition to Portland Ice & Cold Storage Company plant, one of Oregon's oldest. Providing an additional 100,000 cubic foot, the building cost is placed at around $50,000.00. Completion is scheduled for May 15, according to Norman D. Savinar, vice-president of the firm. Western Engineering Company is making the refrigeration additions, cost of which was not given.

AWA-NARW Elects Stecker and Kuehn

Concluding the annual meeting of the American Warehousemen's Association held at the Hotel Adolphus in Dallas on March 10 through 13, Gilbert J. Stecker, president of Merchants Refrigerating Company, Louisville, Ky., was elected General President. Stecker succeeds R. M. King of Syracuse. Elected president of the Refrigerated Warehouse Division was Philip G. Kuehn, president, Wisconsin Cold Storage Co., Milwaukee. Kuehn succeeds S. A. Kadane of Dallas, Texas. Wm. Dalton continues as General Secretary of AWA and Executive Vice-president of NARW. Garth A. Shoemaker was re-elected President of The Refrigeration Research Foundation, a not-for-profit activity originated and sponsored by AWA-NARW. Dr. H. C. Diehl continues as Secretary and Managing Director of the Foundation.

Mellorine Review

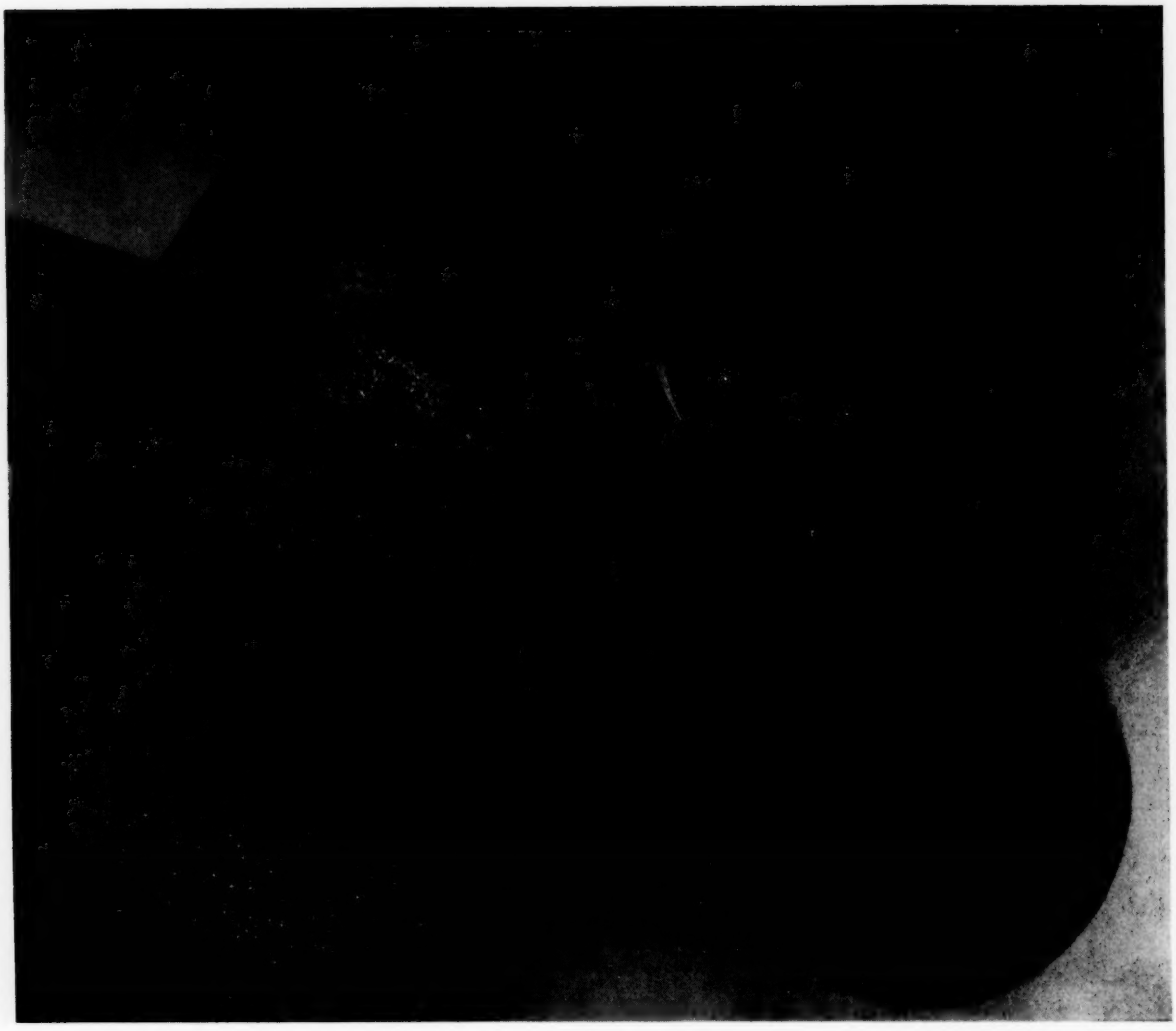
Production and Handling Practices for Mellorine, a Marketing Research Report (No. 212) by the U. S. Department of Agriculture, details regulations applicable to mellorine in each state where it is legal. This frozen dessert, similar to ice cream, is made with vegetable or animal fat and is in production or for sale in 12 states. The USDA report indicates sales of this product have moderated.

Chinese American Frozen Foods

Estimated to cost more than a half million dollars, a 25,000 square foot building of tilt-up concrete slab construction will be erected for Chun-Wong, Inc., frozen food processing concern at Los Angeles, Calif. The project owned by Carson Estate Co. will be located in Rancho San Pedro industrial area, according to announcement made at Los Angeles early in March. The designer of the ultra-modern plant is Eugene Kinn Choy. Co-ordinated Construction Inc. will be the contractor.

Williams Will Head Poultry Industries

Named to succeed Dr. Cliff D. Carpenter as President of the Institute of American Poultry Industries, effective July 1, 1958, is Harold M. Williams, Chicago. The announcement was made by William F. Leimert, Chairman of the Board, IAPI, on March 21. Williams had previously been a director of Fox DeLuxe Foods, Inc. and other meat and poultry packing enterprises, at Chicago. Dr. Carpenter, who has been executive head of the Institute since 1944, last Fall asked the board of directors to relieve him. However, he will continue to serve the Institute in a more specialized capacity.



New Armaflex line includes ⅜", ½", and ¾" nominal wall thicknesses to 3" IPS. On larger piping, Armaflex sheets are used.

Now—3 thicknesses of Armaflex pipe covering for temperatures from 200° down to 0°

Fitting covers can be made up easily and quickly from mitered segments of Armaflex joined with 520 Adhesive.

Armstrong Armaflex now is made in three wall thicknesses—⅜", ½", and ¾". With this complete thickness range, you can specify the economical amount* of insulation to stop condensation, or to save heat, on lines operating from 200° F. all the way down to zero. Armaflex is a highly efficient, flexible foamed plastic pipe covering with a k factor of .28 at 75° F. mean temperature. Its closed cell structure seals out all air, vapor, and moisture.

A big advantage of this flexible insulation is the speed with which it can be applied. Labor costs drop as much as 50%, compared to costs of applying conventional type insulations to pipes and fittings. Armaflex can be slipped over piping before connections are made, or slit and snapped on. Joints are sealed with 520 Adhesive. Fittings are insulated with miter-cut pieces.

* **Recommended Armaflex thicknesses** for various service conditions are listed in free descriptive booklet. For a free copy, write today to Armstrong Cork Company, 2204 Skye Drive, Lancaster, Pennsylvania.

Armstrong INSULATIONS

—Courtesy Argonne Nat'l Lab.

Control rod drives for the Experimental Boiling Water Reactor at Argonne National Laboratories pictured here, are probably familiar to those NAPRE and ASRE members who made the field trips to this Atomic Energy Commission project during the All Industry Show at Chicago, November 1957. Nine rods enter the core of the reactor from the bottom of the vessel. Depth of insertion into the reactor core roughly controls the nuclear activity within. Rods are contained in six foot long thimbles, which are actually long pipes leading into the drive mechanism. Seals prevent any leakage of radioactive water contained in the reactor. For servicing these seals, the thimbles are equipped with a back seating plug or valve similar to the back seating design of refrigerant valves. Failure of the plug to back seat brought about application of an expendable refrigerant which formed a temporary plug or dam, allowing necessary maintenance to be accomplished by reactor engineers.

Expendable Refrigerant To The Rescue At Argonne

Ice Plug Provides Safe Reactor Maintenance

Dry Ice and Alcohol Used in Service Technique

REACTOR maintenance, similar to any plant servicing, can be quite safe if everything operates as it should! However, when a small item in a reactor is deranged, like the simplest control in a refrigerating system, the repair may involve time-consuming and costly shutdown. Last Fall one of those unpredictable occurances developed in the routine service to a control rod drive mechanism at the EBWR, Argonne Laboratories, Lemont, Ill.

A new method of reactor maintenance involving use of dry ice and alcohol was applied by Laboratory engineers. The service operation involved freezing water in the lower portion of one of the nine control rod thimbles. This freezing technique provided an ice dam so that maintenance could be carried out below the freezing point without danger of releasing radioactive water from the reactor core.

These thimbles are six foot long pipes (see figure at left) leading into the control rod drive mechanism, the machinery that controls the rate of reaction, below the reactor vessel. During EBWR operation, a seal mechanism at the outlet of each control rod thimble, attached to the bottom of the pressure vessel through which control rods are operated, provides a pressure breakdown, i.e., seals water in the reactor. Outside the seal, pressure is at atmospheric level. Inside, pressure is maintained at the operating level of the reactor. A device similar to a valve, called a back seating plug, is installed directly above the seal, to service it.

Rod Operation

During operation, the back seating plug rises off its seat with the movement of the control rod. During shutdown, the plug is closed by drawing a control rod down tight. Maintenance on the control rod can't be carried out when the plug is off its seat. In normal maintenance, provision is made to remove the control rod mechanism, when necessary, by dropping the rods until the back seating plugs close at the seal points.

In October 1957 EBWR personnel wanted to remove and clean the seal and dash pot, a hydraulic shock absorber, on one of the thimbles, but the back seating plug would not seat, or close. This may have been caused by a small chip of metal that lodged itself between the plug and the seal. It meant that removal of the mechanism would cause leakage of radioactive water from the core.

To remove and clean the mechanism, required some method of blocking release of radioactive water from the core. The only alternative would be the lengthy process of draining the water from the core. This would involve removing all the fuel elements, draining, then reloading the core, approximately six days of work, around the clock. A mixture of dry ice and alcohol could be applied to the thimble in question, freezing it and providing an ice dam above the back seating plug for a protective shield.

The maintenance engineer group had a four inch area of pipe to work on, between a flange and a steel retainer plate that provides structural retainment for the nine thimbles. Refrigeration was a two inch deep mixture of dry ice and alcohol in a shallow pan, at a temperature of minus 70 F. The mixture was applied for five hours. Then the flange was loosened, and there was no leakage. The flange was removed, and examination showed ten inches of ice in the lower portion of the thimble, more than enough for protective shielding. The mechanism to be cleaned could now be removed at will.

Back On The Line

After cleaning, the mechanism was reinstalled, the ice thawed, and the machinery pronounced ready for operation; within eight hours from the start of the experiment! A spokesman said this type of maintenance is typical and necessary for all types of reactors. He added that this was the first instance of the freezing technique, used in other engineering areas, being applied at Argonne.

By R. F. McKEE

About the Author —

Mr. McKee graduated from the University of California in 1940 with a degree in mechanical engineering. In World War II, he served in the U. S. Air Force as a pilot, spending three years with the Air Material Command doing development work and test flying. He joined Pacific Fruit Express Company upon release from military service in April 1946. He has participated in the company's post-war modernization and expansion program in most every plant in PFE system. He is vice-president of California No. 1 Chapter, NAPRE.

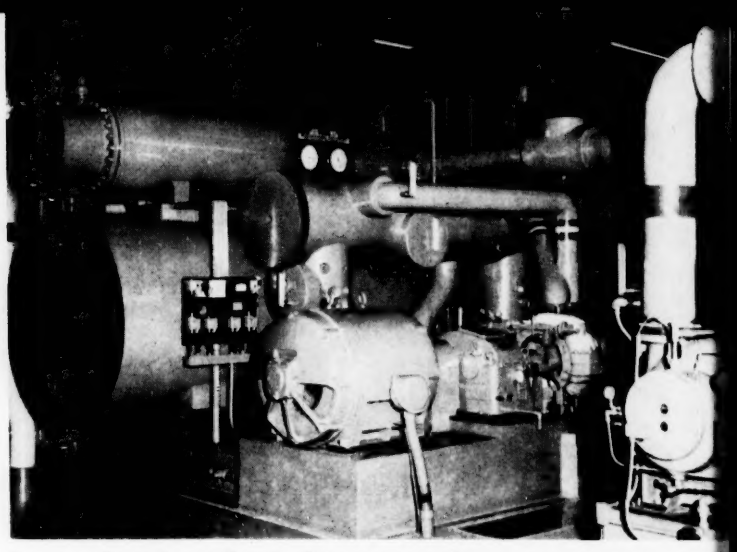


Fig. 1 — Typical centrifugal refrigerating machine in an automatic operati application; motor, speed increase and compressor in foreground; evaporat in rear with condenser above it, and the intercooler in between.

AUTOMATIC OPERATION of

»» AVAILABLE to the refrigeration industry today is a centrifugal refrigeration machine of many configurations. The refrigerating engineer now has at his disposal a device that can be adapted to almost any refrigeration process. This useful tool can be applied directly to product cooling in a manufacturing process, to refrigerant condensing alone or in conjunction with an existing compression system, or in cooling a secondary refrigerant such as brine or water.

To any of these applications this machine with the whirling element brings the inherent advantages of the centrifugal compressor: compact design, lack of numerous moving parts with their attendant vibration, simplification of the overall system, lower first cost, and lower maintenance cost. In addition, the centrifugal machine offers a possibility of greater potential salvage value. In the revision or alteration of a plant or process, it, being self contained, is easily moved or adapted to different conditions.

The centrifugal refrigerating machine consists of a package made up of a centrifugal compressor with its driver, an evaporator, condenser, intercooler, and controls all mounted on a compact base, such as pictured in *Fig. 1*. Material to be cooled is pumped to and from the evaporator, and heat is rejected to cooling water through the condenser. Lubrication system, purger, and instrumentation are all self contained in this package.

Compressor Characteristics

The centrifugal compressor has the operating characteristics of all centrifugal apparatus, whether a pump, a fan or a compressor, in that the capacity is proportional to the head across the suction and discharge against which it must operate. And, in a manner similar to pumps and fans, there is a maximum head at which the compressor will pump, commonly called "shut-off" head; also, a minimum head beyond which the capacity will not increase due to the physical limitations of its refrigerant gas passages. The performance curve of any centrifugal compressor can then be plotted with output in terms of CFM or Tons Refrigeration (TR), against head, in terms of Btu content of the gas at suction and discharge conditions. The compressor is therefore selected according to the demands.

However, the curve flattens out at the higher head conditions and the compressor reaches an unstable condition where at a given head there are two or more apparent capacities, and the machine will surge or hunt between them.* In normal operating range, the centrifugal compressor has the fortunate characteristic of large change in output for a relatively small change in evaporating temperature. This enables it to float with the load and respond to large load changes with relatively little change in evaporator temperature. But, since at the lower load conditions a slight rise in the evaporator temperature will be coupled with a drop in condensing temperature due to the decreased load, the net overall head will be reduced and the compressor will be capable of greater output at a time when it is not required.

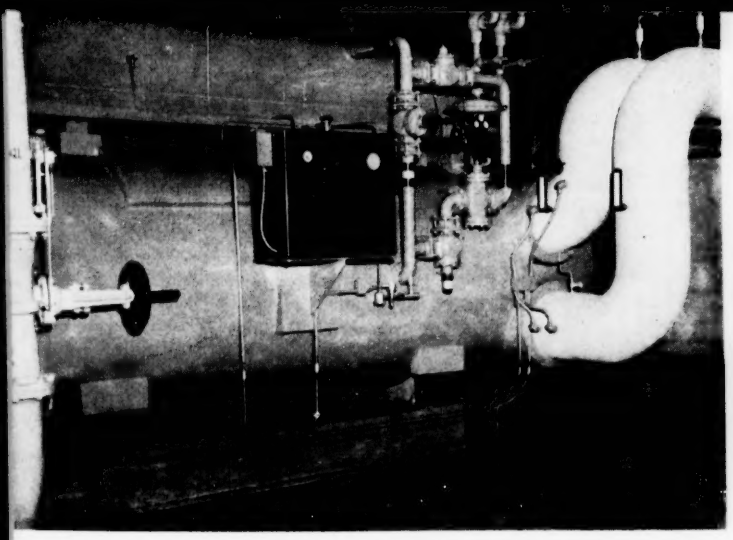
Methods Used To Broaden Operating Range

Obviously some method of capacity control is required. This can be done either by changing the speed of the compressor such as on a turbine or

*This is a greatly simplified explanation of the condition of "hunting". For a complete description refer to *Centrifugal Refrigeration*, by G. R. Wachter; *Ice and Refrigeration*, June, July, August, 1946.

AIR SUPPLY 100 PSI

When the compressor is running the



g. 3 — *Rear view of centrifugal machine: evaporator below, condenser above; condary refrigerant lines at right, cooling water at left; purger at center, automatic hot gas bypass unloader in right center.*

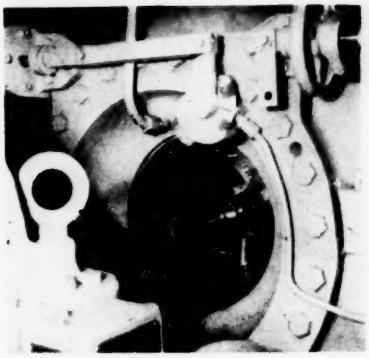


Fig. 2 — Inlet vanes of one type centrifugal compressor. Although pneumatic vane operator and linkage is provided (at top), note hand wheel for alternate manual operation.

CENTRIFUGAL MACHINES

slip-ring motor drive, or by altering the suction conditions. The latter can be accomplished by using a butterfly valve or damper in the suction to the compressor which increases the overall head, or by using inlet vanes at the first stage impeller which impart a rotation to the gas before it enters the impeller. The inlet vanes permit a wider range of control before they close to the point where they act the same as the damper. *Fig. 2* shows the vanes, partially closed.

Automatic Operation

Since even with these methods of control a surge point will be reached at very low loads, another means must be provided for unloading if it is desired to operate the compressor under these conditions. This can be accomplished by a hot gas bypass between the condenser and evaporator. With this arrangement it is possible to go to zero output, but the hp/TR of capacity will of course be poor under these conditions. *Fig. 3* is an illustration of a hot gas bypass arrangement with diaphragm valve for automatic operation.

Capacity control can be made automatic by sensing the temperature of the cooled medium and by means of a controller adjusting the damper or vanes to obtain the desired temperature. The control system can be either pneumatic or electric, using air actuators or electric motors to position the vanes.

Shown schematically in *Fig. 4* is an arrangement of a pneumatic control system for a fully automatic operation. The temperature controller has a sensing element located in the system at the point where control can be best effected, usually in the outlet of the cooled medium from the evaporator, but sometimes in the return line or even at a remote point in the process. In some cases a selector switch is used to change the point of control as process demands differ.

The controller provides an output air signal which varies with the demand for refrigeration required to maintain the temperature at the desired point. This signal is used to actuate the compressor suction damper or vanes and the hot gas bypass valve, usually by means of positioners which actually use supply air pressure for the "muscle" required to operate the vanes and valves due to their size. However, the signal to the vanes is modified by two additional elements; a 3-way solenoid valve which vents the signal air to atmosphere during the stopped period so the compressor starts with vanes closed (unloaded), and a current relay which bleeds the air according to the motor current being drawn.

The solenoid valve is connected into the motor control circuit so that it is energized only when the motor is running. The current relay is connected into the motor power circuit so that when rated motor current is exceeded it begins to close the vanes until the current is reduced to the proper value.

A restrictor is usually employed as shown to limit the rate at which the vanes can close to eliminate hunting of the current relay. The use of the motor current limiting relay permits the automatic operation of a centrifugal compressor under any conditions, especially during starting up a system when the hot load will increase the suction pressure to the point where it overloads its motor.

The air signal to the hot gas bypass valve also usually actuates a pressure switch to open a liquid refrigerant injection valve in the bypass line to prevent excessive temperatures in the hot gas fed to the evaporator.

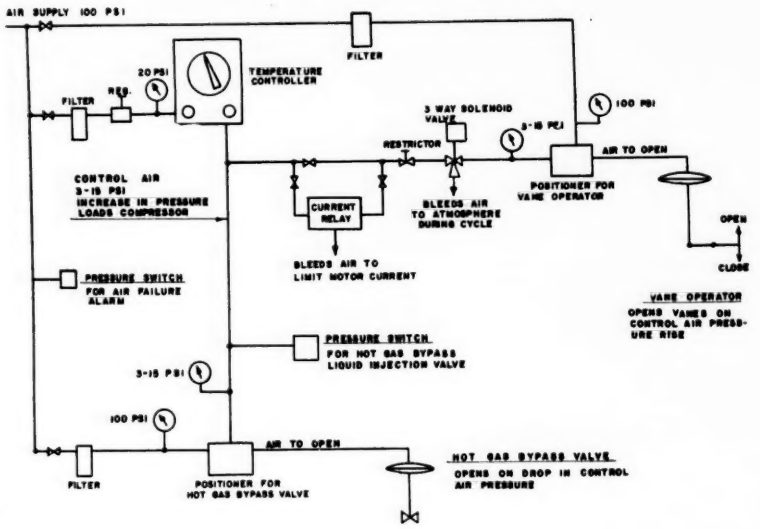


Fig. 4 — Schematic diagram of pneumatic control system. Sensing element of temperature controller would be located to suit requirements, usually in secondary refrigerant outlet evaporator. Compressor unloads on air failure.

This prevents the possibility of excessive suction superheat and resultant overheating of the compressor. By proper setting of the positioners the hot gas valve remains shut until the vanes are almost closed before it opens, thus allowing the compressor to operate with normal control until it is unloaded to less than 50 percent. This is important to prevent excessive hp requirements during normal operation. At the option of the engineer an additional switch is sometimes used in the air signal line which stops the compressor when the load reaches a certain minimum. Such an arrangement prevents prolonged operation with the bypass open, and saves power.

Control Incorporates Safeties

Fig. 5 depicts a typical motor control circuit diagram with these safety elements, plus the other functions necessary for the complete circuit. In addition to the safety controls there will be the motor overload cutouts, electric-panel door interlocks, sequence timing for more than one unit, and possibly a remote shut-off switch for emergency shut-down. These are classified as *lockout* or *non-lockout* functions, depending on whether it is desired to have an operator inspect the system before it starts again. Obviously this would be the case for bearing temperatures since it would be undesirable to have the machine automatically restart when they cooled off. These controls are thereby lockout type requiring manual resetting after trip-out.

It can be seen from the diagram that when the circuit is completed between L1 and L2 the motor will run. Thus, the devices should all be selected of the fail-safe type; that is, they are open when de-energized or upon any trouble. Therefore, the circuit must be proven or the motor will not start. However, it is obvious that when the compressor is stopped there is no oil pressure in either the gear box or the compressor lubrication systems and the respective oil pressure switches would be open, making it impossible to start the motor. A time delay relay is inserted in the circuit (shown as GOP in Fig. 5), which closes a contact in parallel with the oil pressure contacts for a given time period after closing the starting switch, sufficient to allow the oil pressure to rise to its operating value.

Interlocked Lube Circuits

In the case of the compressor oil pressure this is not satisfactory as the high rotative speed makes it undesirable to operate for the length of time it takes for the oil pressure to rise. Therefore, an auxiliary pump is used which is started before the compressor motor (shown as OP in *Fig. 5*). It can be seen that when the *Stop-Run* switch is closed and all safety functions are satisfied, the auxiliary pump will start. It brings up the oil pressure which then closes the compressor oil pressure switch, allowing the compressor motor to start.

When the compressor is running the oil pressure actuates another switch having normally closed contacts in the oil pump circuit, stopping this pump. The pressure settings of the two switches are adjusted so that the auxiliary pump pressure is sufficient to close the compressor oil switch and the compressor oil pump pressure is sufficient to open the auxiliary oil switch. This arrangement also makes the auxiliary oil pump act as a standby pump during operation as it will start at any time the main oil pump is unable to sustain the required pressure. Pressure switches and elements of the lubrication system are shown in *Fig. 6*.

Trouble-Shooting Simplified

The various safety controls are usually grouped together in a convenient place on the machine, such as on the small sub-panel pictured in *Fig. 7*. This grouping of instruments simplifies wiring to the main control board and makes it easier to check the operation in case of trouble.

Audio-Visual Alarms

The alarm circuit consists of all the safety elements which would shut down the machine, connected to an annunciator panel with a warning bell or horn. One method is to have each safety element actuate a relay, one contact of which is in the motor control circuit as shown in *Fig. 5*, and the other in the alarm circuit. Any trouble will then stop the machine, sound a warning, and light an indicator on the panel board announcing which safety element was actuated. This circuit is equipped with a test button for checking lights and horn, and a silencing button which stops the audible warning but leaves the light on behind the panel which signifies the trouble. The annunciator panel can be seen at the top of the control section in *Fig. 8*.

Other information can be fed to the annunciator such as indications of operation of pumps and other auxiliary equipment, and further classified by selection of color of the indicator. This is very helpful during starting of the machine. When first putting it on the line, the indicator panel can be used as a check list. Requiring all visual signals of a certain color to be out would show that all necessary auxiliary equipment is properly operating before starting the compressor. For example, one indicator bulb, pane, or other signal can read "Condenser Water Pump Stopped". When the operator sees this he starts the pump and as soon as flow is established the condensing

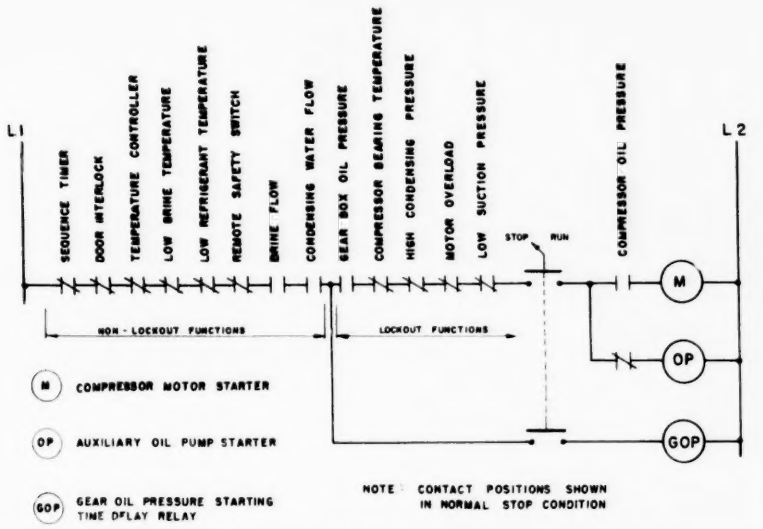


Fig. 5 — Compressor motor control circuit. All functions are in series and circuit must be proven before motor will run. Lockout functions must be manually reset. Motor is actually started by oil pressure rise after "Run" switch closes.

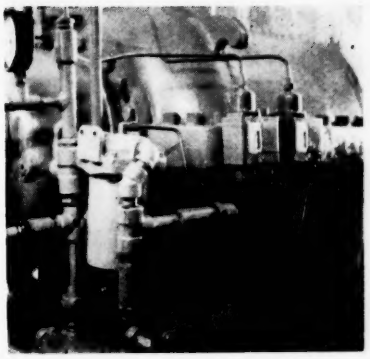


Fig. 6 — Elements of the lubrication system, showing the oil pressure switches, one of which starts the compressor and the other stops the auxiliary pump when pressure is normal. Note filter in center, cooler at bottom, and thermocouple in oil line just above the gauge connection.

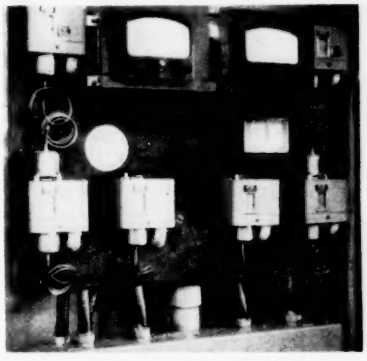


Fig. 7 — Sub-panel at machine where elements of the safety controls are grouped for convenience. Included are cutouts for temperature, pressure, flow (double bellows) and thermocouples for two main bearings.

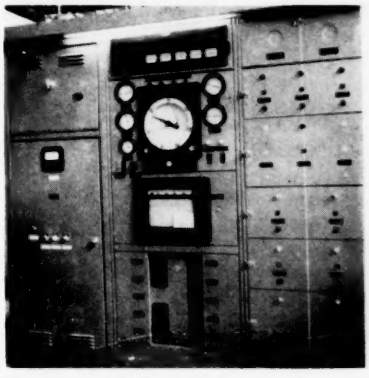


Fig. 8 — Main control panel for one machine; main motor starter at left, auxiliary motor starters at right, with control and recording equipment in center. Note the annunciator panel at top which signals the source of troubles. Recorder 12 points.

water flow switch closes and the signal which had been activated goes out, telling him this part of the circuit is completed. This can be a very important factor in the operation of an automatic plant where machines are not started very often and perhaps by many different persons.

Discussion of the control and protection of the centrifugal refrigeration system for automatic operation cannot be complete without consideration of data recording. To adequately inform all concerned as to how the equipment behaved during the time it was operating with no one in attendance, it is necessary to record temperatures (and/or pressure) at certain points in the systems.

Instrumentation

Fig. 9 shows a schematic arrangement of the centrifugal machine with temperature and pressure readings indicated for a complete log of the system. The most practical and least costly method of logging as many as twelve temperature readings is by the thermocouples and a strip chart recorder. The readings are plotted on the chart in rotation using different colored symbols to differentiate them. The recorder holds a chart which will last for 30 days, and each day may be torn off and filed separately. A glance at this chart will quickly reveal any temperature reading that has been erratic or off its normal range. It also has the advantage of having all temperatures recorded on the same chart so that any malfunctioning will show the relationship of the readings before, during and after; a point which is very helpful in diagnosing troubles after they happen.

The recorder uses copper-constantan thermocouples measured with a continuous balance potentiometer circuit, and can be selected for any applicable range, a common one being 0 to 250 F for industrial centrifugal installations. It is seen as the rectangular cased instrument on the panel in Fig. 8. A portion of the chart is shown in *Fig. 10*.

With a complete record of all temperatures it may not be considered necessary to record the suction and discharge pressures since they are not independent functions. In most cases daily check of these pressures as read from gauges against the suction and discharge temperatures will tell the operator if the unit is functioning properly. Likewise there should be a way of daily checking cooling water and secondary refrigerant flow from indicating meters, but since these values do not change rapidly recording may not be considered necessary.

Engineering The Plant

Consider the centrifugal refrigeration machine in its relation to the balance of the plant. While it is a complete high- and low-side refrigeration system the fluid to the cooled must be fed to it, and the heat removed from this fluid must be rejected through the cooling water circuit. Pumps and piping arrangements must be planned to fit the special requirements of the centrifugal ma-

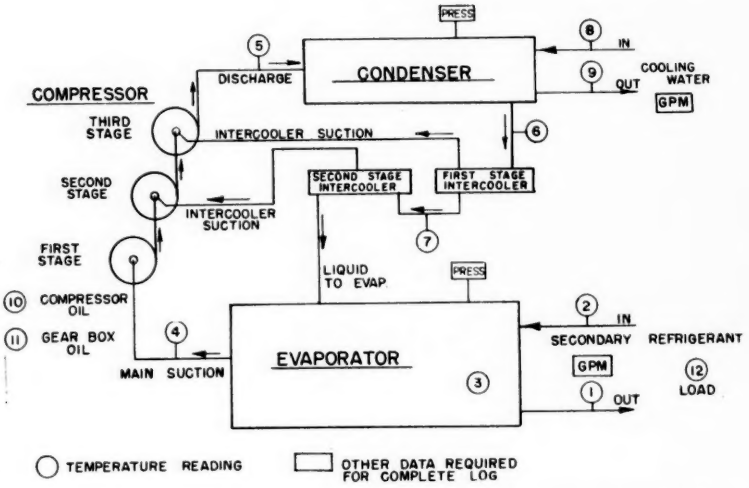


Fig. 9 — Schematic flow diagram indicating points at which data should be taken for record purposes. Temperatures should be recorded continuously. Flows and pressures may be logged by personnel supervising the equipment.

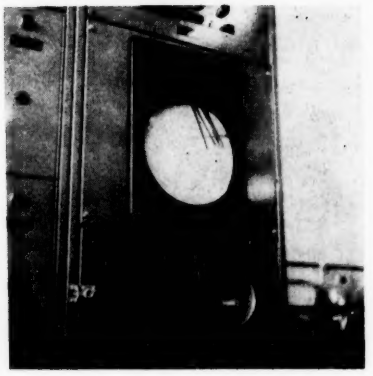


Fig. 11 — Cooling tower fan control, recording water on and off tower. Upper index changes fans from high to low speed, lower index from forward to reverse, on a cycle controlled by the timer seen below.

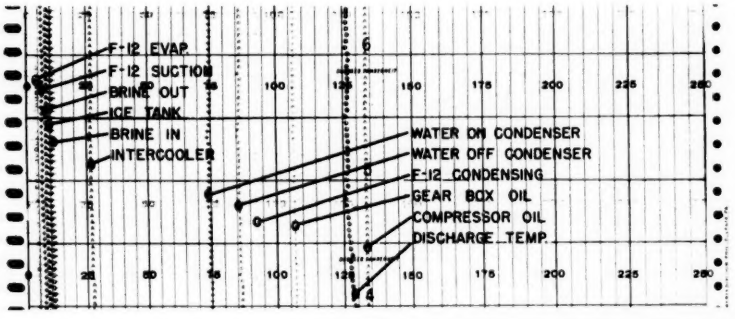


Fig. 10 — Section of the continuously recording temperature chart. All essential data is contained herein to enable comprehensive checks of operation when machine is unattended. Chart markings are actually in color to facilitate reading.

chine and a well planned installation will take advantage of the many selections of heat transfer surface available in these machines.

The decision as to the proper evaporating temperature will be governed by the flow of the medium being cooled, its lowest desired temperature, permissible pressure drop through the evaporator, and the cost of the heat transfer surface to meet the best compromise of conditions.

In addition there is a choice of primary refrigerants available for use in the centrifugal system and whether they will be evaporated in the tubes or in the shell of the cooler. Many different styles of finned tubes and different tube materials are available to give the best performance and longest life.

One method of holding down initial cost is to circulate only a portion of the secondary refrigerant through the cooler and lower its temperature considerably below the required temperature, mixing it with the balance of the total circulation to control the final temperature. This gives the greatest Temperature Difference to reduce the size of the heat transfer surface, and reduces the pump cost.

Similar consideration must be given to selection of condenser surface, depending on source of cooling water. Most installations will use cooling tower water and the economics of the combined tower, condenser and pump installation must be considered.

Minimum Condenser Pressure Northern Climate Factor

An important point to remember where operating in cold climates is that a minimum head pressure must be maintained so that sufficient pressure differential is available for proper operation of the refrigerant flow valves. Where it is anticipated that cooling water temperature will go low enough to cause this condition, flow control valves should be installed to automatically maintain minimum condenser water outlet temperature.

Winter Tower Operation

Where icing of the cooling tower is also a factor, another method of controlling water temperature is by specifying two-speed fan motors for the cooling tower. A simple temperature controller can be used to switch the tower fans to low speed when the water goes below a certain temperature, this value being obtained by experience with the system. This arrangement is of two-fold value as deicing can be accomplished by running the tower in reverse at low speed and using the heat in the condenser water to melt the ice accumulated at the tower air inlet.

This can be done automatically by using an additional wet bulb temperature controller. When conditions of both low water temperature and low wet bulb temperature are encountered, the tower goes into the defrost cycle. During this period a timer switch runs the tower fan for predetermined periods in forward and reverse, the period depending on the time necessary to defrost during reverse and to refrost during normal operation.

Fig. 11 shows a recording controller, with the two pens recording water temperature on and off the tower. The upper index is set to control the tower fans from high to low to maintain the proper operating temperature. The lower index is set to permit the timer seen below to operate the tower in forward and reverse for defrosting in conjunction with the wet bulb controler seen in *Fig. 12.*

Fig. 12 — Relay panel for tower fan control, including time delay relays for forward and reverse automatic switching. On the left wall is the wet bulb controller which, with the water off temperature, controls the defrost cycle.

Also seen in this view are the reversing relays in the top of the compartment with the time delay relays just below them. The function of the latter is to allow the tower fans to come to rest before reversing their direction. This, of course, lessens stresses in the driving equipment. *Fig. 13* is a chart from this recorder on which can be seen the effect of the high and low speeds.

Adequate Piping Important

One other consideration should be given to the piping arrangement with centrifugal machines and this is the inclusion of sufficient valves to permit cross connection of pumping systems when more than one unit is used. For much of the season it may be possible to operate one machine on combined loads at more nearly its rated capacity rather than two machines at less than half capacity, increasing the overall plant efficiency accordingly. Similarly, one cooling water circulating pump may be able to carry two machines on light loads, reducing the pumping costs. A condenser water pump installation for four centrifugal machines, with the pumps through 3-way valves for cross connection, is shown in *Fig. 14*.

By the use of the methods outlined, it has proven possible to apply centrifugal compressor systems to most automatic industrial applications, with the advantages of low initial cost, reduced maintenance and operating costs, high degree of dependability and accuracy of operation; all of which are the ultimate goal in the design of modern refrigeration plants.

*Complete story in IR, soon.

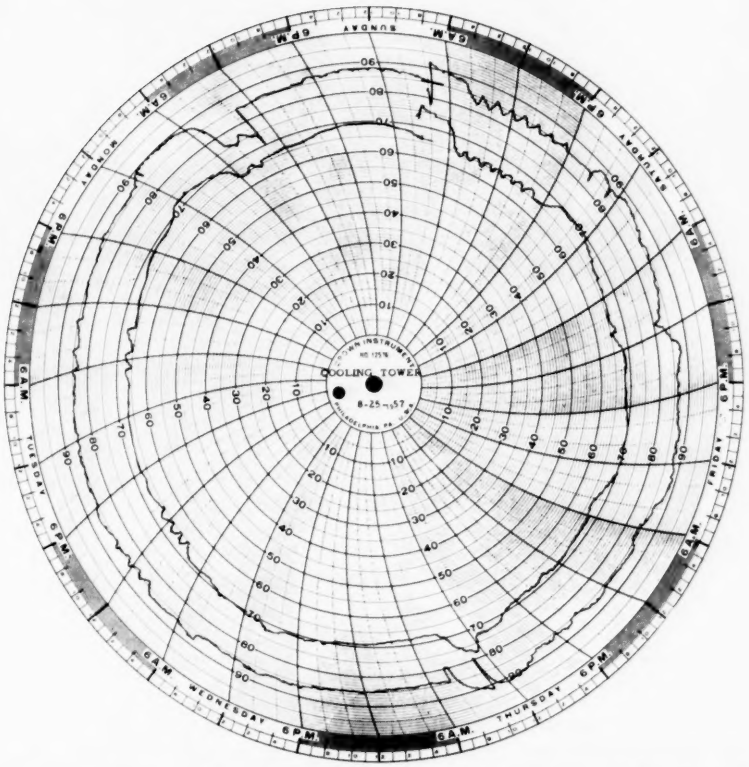


Fig. 13 — Section of chart shown in Fig. 11. The sawtooth characteristic records operation of the high-low fan control to save fan horsepower during cool periods at night. This is a seven day chart showing water on and off the tower.

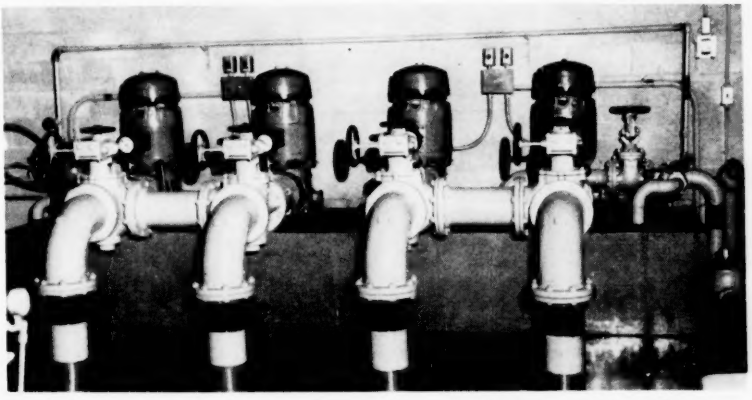


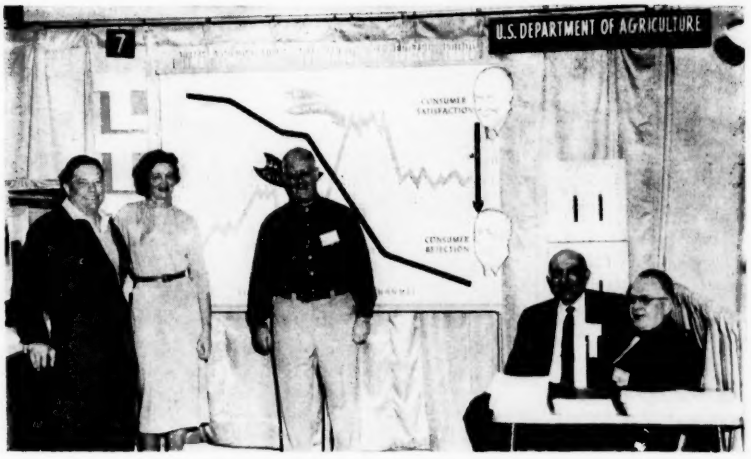
Fig. 14 — Arrangement of condenser water circulating pumps for four centrifugal systems. Note how pumps are grouped in pairs with cross connections by 3-way valves for protection. At right is the water makeup control and meter.

About the Author's Most Recent Plant —

Advantages of the centrifugal expressed by the author in this paper are the same considerations taken in the design and construction of the Pacific Fruit Express Co. plant at Ogden, Utah in 1957. Essential features of the Ogden plant included four centrifugals, each 285 TR with 450 hp motors, cooling sodium chloride brine for the ice tanks and storage refrigeration.*

In an interview, McKee stated "The most interesting thing to me is that with the economies that were practiced, this plant actually cost less per rated ton of capacity than the Laramie plant constructed in 1951". INDUSTRIAL REFRIGERATION reported on the Laramie plant, a completely automatic reciprocating compression ammonia system, in April 1951, February 1953 and August 1956.

TRRF Reports on Gains in Record Meeting



U. S. Department of Agriculture Exhibit at National Association of Refrigerated Warehouses Dallas Convention featuring "Time-Temperature-Tolerance" studies on frozen foods. Left to right: L. J. Urban, California Consumers Corp.; Dr. Helen Hansen, Western Utilization Research Laboratory; Dr. H. C. "Dutch" Diehl, TRRF Director and Secretary; S. H. Kadane, President NARW and G. A. Shoemaker, President TRRF.

RECORD attendance helped in the making of a highly successful annual meeting of The Refrigeration Research Foundation, held in Hotel Adolphus, Dallas, Texas, March 6-8. According to many members, the gathering also set a record for intensity of interest in new refrigeration developments.

As usual, the first two days of the annual meeting were devoted to review of industrial and scientific progress in various commodity areas and in refrigeration engineering. Present were 17 of the 22 scientists, engineers, and industrial leaders who comprise the Foundation's Scientific Advisory Council. These men reviewed commodity fields and led discussions in which representatives of refrigerated warehouse companies participated.

Opening these meetings, Dr. H. C. Diehl, Director of the Foundation, called attention to the "rapid, fluid state of industrial development, not only in refrigerated warehousing itself, but in all the industries that refrigerated warehousing companies serve—that is, in all the commodity industries. For that reason," he said "warehousing companies always have a special interest in new technology."

"The program that the Foundation pursues," said Dr. Diehl "continues to be as conservative, comprehensive, and sound as possible—and progress has been recorded during the past year as in the previous 15 years. More attention, of course, is given to educational and action programs than in the past, because a mass of new information has accumulated that requires translation into industrial use."

He particularly mentioned the large "Time-Temperature-Tolerance" project which deals with measurements of quality loss in frozen foods as related to industrial handling hazards. An Inter-Industry Task Group—spearheaded by National Association Frozen Food Packers is carrying on educational activity with results of this project and of related research.

Other activities reviewed by Dr. Diehl include the Foundation's participation in affairs of the International Institute of Refrigeration, which is becoming more active worldwide and is an advisory agency in national governmental research.

Scientific Advisory Council

Here are some highlights from the two days' discussions of technical advancements:

Dr. Walter V. Price of the University of Wisconsin reported that on March 19th and 20th details of a new method of manufacture of milk concentrate will be announced at public and technical meetings in Madison, Wis. The aim of this research has been to prepare a concentrate suitable for a wide shipping range. Thus, the aim has been a sterile, fine flavored product—one that will tolerate substantial periods at room temperature, although cool temperature will be beneficial for long periods—particularly for best protection of color.

New developments in "puff" drying of milk (under vacuum), continuous methods and shorter batch methods for cheese, more efficient methods for butter, the possible use of irradiation, and numerous new processes for new or old products were reviewed. Many of these suggest eventual demands for new storage or partial processing services on the part of refrigerated warehousing companies in the future.

For both poultry and red meats, most promise for large development lies in the field of prepared frozen items, according to Dr. Cliff Carpenter of Institute of American Poultry Industries, and Mr. Clarence K. Wiesman of Armour & Co.—both members of TRRF's Scientific Advisory Council. Frozen consumer packs of red meats are still problematical, according to Mr. Wiesman, but prospects for institutional frozen red meats are better since they offer advantages of precutting and other kinds of conveniences. Dr. Harold Schultz of Oregon State College, a Council member, said research is needed on tenderization of lean meats, on factors involved in toughness, color, drip, and other problems.

Dr. E. A. Fieger, Louisiana State University, and Mr. Charles Butler of U. S. Fish and Wildlife Service reviewed problems in fishery industries. A wide range of research is under way—particularly on initiation of deterioration shortly after fish are caught.

Considerable interest centered on a report by Mr. H. P. Schmitt, Research Director for National Association of Frozen Food Packers and a TRRF Council member on results of NAFFP's survey of retail handling of frozen foods, co-sponsored by Association of Food and Drug Officials of the United States. The survey covered 558 stores and 1336 cabinets widely distributed. Almost half (46 percent) were found at 0° to -5° F, 22 percent at 1° to 5° F, 24 percent at 6° to 15° F, 7 percent at 16° to 25° F, and 1 percent above 26° F.

Expanding its technical program, NAFFP plans an expenditure of $300,000 over five years on a five-part

Meeting of the Scientific Advisory Council, The Refrigeration Research Foundation, Dallas, Texas, March 7.

program on regulatory matters, expansion of technical services, studies on nutritional factors not covered in an earlier project, Time-Temperature-Tolerance studies, and research on special quality problems. Harold J. Humphrey, Chairman of NAFFP's Scientific Research Council, has been elected First Vice President of the packers' association.

Dr. M. J. Copley, Director of USDA's Western Utilization Research Division in Albany, Calif., and a TRRF Council member, reported recent progress and plans in the large Temperature-Tolerance project. Dr. E. P. Christopher of University of Rhode Island and W. T. Pentzer of USDA discussed aspects of irradiation research and new general developments in fresh fruits, vegetables, and nursery stocks. Prof. Carl Kayan of Columbia and Dr. Guy Woodroof of Georgia Experiment Station discussed progress on control of condensation. Mr. Edward Simons of San Francisco, Dr. W. H. Cook of Canada, Dr. D. K. Tressler of Westfort, Conn., discussed a wide variety of subjects, including irradiation, antibiotics, new products, new processes and methods. Mr. Allyn C. Beardsell, President of Container Laboratories, Inc., New York, discussed new developments in packaging, such as: improvements in multiwall bags, new cartons that require no liner nor overwrap, aluminum cans, and antiskid containers.

About 75 representatives of member warehousing companies participated in the two-day sessions of this council.

Membership Meeting

The Foundation's membership meeting on Saturday, March 8, featured speeches by Dr. Samuel C. Prescott, Chairman of the Board of Governors; Dr. W. A. Schoenfeld, Associate Chairman; Mr. Garth A. Shoemaker, President of the Foundation, and a program of technical reports as follows:

Controlled Atmosphere Storage of Fruit, by Dr. A. E. Van Doren, State College of Washington

Nursery Stock Storage, by Dr. John M. Harvey of USDA, Fresno, Calif.

Refrigerated Storage of Bermuda Onions, by Dr. G. W. Adriance of Texas A & M College

Water Control in Refrigerated Warehouses, by Ralph Westcott of Los Angeles

Refrigerated Storage of Dates, by Dr. G. L. Ryg of USDA, Pomona, Calif.

Immersion Freezing of Poultry, by Dr. Wm. Stadelman of Purdue University.

Dr. Prescott reviewed contributions of the Foundation to progress of refrigeration over its 15 years and discussed particularly how research builds the future of America, Dr. Schoenfeld, the national and international aspects of research.

President Shoemaker made a special point of the threat of a trend toward conformity in our thought and action. "The men who are heads of American business today," he said "including heads of refrigerated warehouses, did not get there by suppressing their initiative and creative thinking. They didn't get there by going along with the current trend or accepting prevailing opinion.

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Col. Paul P. Logan, Formerly Director of Food Research, National Restaurant Association, Orlando, Fla.

Dr. Harry J. Reed, Director and Dean, Indiana Agricultural Experiment Station, Purdue University, Lafayette, Indiana.

Dr. William A. Schoenfeld, Emeritus Dean and Director, Oregon Agricultural Experiment Station, Oregon State College, Corvallis, Oregon.

Term Expiring 1959

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Jules L. Gagini, Omaha, Nebr.
J. R. Goodfellow, Seattle, Wash.
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William E. Martin, Vancouver.
Harlan J. Nissen, Los Angeles.
Garth A. Shoemaker, Elmira, New York.

Term Expiring 1960

S. A. Kadane, Dallas, Texas.
E. M. Dodds, Kansas City, Mo.
John L. Bear, Wichita, Kans.
P. D. Burrill, Boston, Mass.
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J. W. Straub, New York, N.Y.

Term Expiring 1961

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Millard W. Young, San Francisco.

"Instead, as this Foundation bears mute evidence, they questioned prevailing opinion and practices. They dared to look into the future with imaginative vision, and they brought out their own ideas and fought for them."

Fellowship Award Winner Announced

John M. McGill, graduate student in University of Illinois, has won the Foundation's Samuel Cote Prescott Fellowship for the year 1958-59. This award goes to a qualified graduate student who is engaged in research within the Foundation's range of interest and carries a stipend of $2500.

McGill has previously been employed by Standard Brands, Inc. and Campbell Soup Co. He obtained his master's degree in 1957 and is now embarked on the Doctor of Philosophy in Food Technology at University of Illinois. Last year's winner of the award, Sam R. Cecil, was present and described his project on storage of filberts at the Oregon State College Experiment Station.

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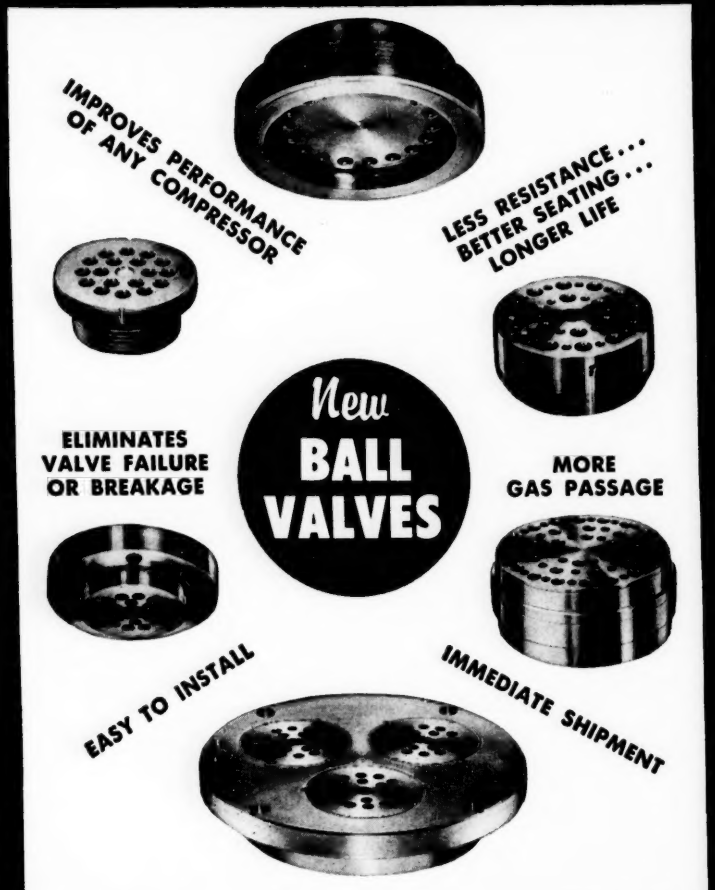

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Reducing Decay in Peaches

ALTHOUGH hydrocooling is a very effective method of rapidly cooling peaches, ice water in itself has little or no effect as an inhibitor of brown rot or rhizopus rot fungus. It takes a chlorine or Dowicide A solution to do the trick. This is the finding of T. T. McClure, associate pathologist in the quality maintenance and improvement section of the Agricultural Marketing Service in Beltsville, Md.

McClure recently made a laboratory comparison of postharvest decay in inoculated peaches hydrocooled in solutions containing Dowicide A or chlorine and in plain ice water. He found that adding Dowicide A or chlorine significantly reduced decay. Of the two, Dowicide A was the best. Hydrocooling with 0.1 percent Dowicide A reduced brown rot 64 percent and rhizopus rot 17 percent. A solution containing 200 parts per million of chlorine cut brown rot 29 percent and rhizopus rot 4 percent.

The Dowicide A treatment followed by a refrigerated holding period (5 days at 40 F) worked even better. This combination reduced brown rot 91 percent below that of nonhydrocooled peaches ripened immediately. It cut rhizopus rot 47 percent.

National Tea Takes Piggly Wiggly Division

ILLINOIS Valley Stores, chain of Piggly Wiggly supermarkets in the Peoria, Illinois area were purchased by National Tea Company, according to a January report. The new outlets give National seven stores in Peoria, East Peoria and Pekin, Ill., where the company has not operated until this time. The new chain will be operated and serviced by National's branch in Davenport, Iowa. In an earlier January report the Tea Company reported another new sales high for the 15th consecutive year.

At the close of 1957, National had 883 stores in operation compared with 761 a year earlier. During the year, the food chain placed 59 new supermarkets in operation, 43 in new locations and 16 relocations of existing retail stores. In addition to the Peoria stores chain, by acquisition National added 119 stores in the trading areas around Denver, Sioux City, Nashville and Mobile. The company plans 126 additional stores in 1958, 101 new locations and 25 replacements. Twelve new supermarkets were opened in the first four weeks of the new year.

Poultry Industry Highlights Refrigeration Uses

Howard Richey

Carl Shaver

Jos. H. Mueller

ENGINEERING for best immersion freezing results, keeping fresh poultry iced, and six points for improving the sales chances with the chain store buyer, were three speaking highlights of the 29th Fact Finding Conference of the Institute of American Poultry Industries. The meeting held at Kansas City, Missouri, on February 15, featured Howard H. Richey of the Central Cooperative Turkey Producers, on the immersion freezing topic; Carl Shaver of J. K. Southerland, Inc., on the ice packed poultry, and J. H. Mueller of the National Tea Co., in role of chain store buyer.

Immersion Freezing Experience

According to Richey, with the Ellsworth, Iowa Coop, there is nothing mysterious about immersion freezing. It is a very simple method, he related, as he described the Central Cooperative turkey producers experiences. Engineering is the one principal problem; that of fitting the equipment to the individual operation, according to capacity, plant layout and methods desired. The Cooperative uses an immersion tank for their method. The salt solution vessel measures 54 x 12 x 3' 4" high.

Immersion freezing was installed in the Ellsworth plant for one reason: to give each and every turkey processed a uniform and desirable color that would appeal to the consumer. Richey says the mission has been accomplished. In the past season Central processed practically its entire production, more than 10 million pounds, through the immersion tank. Birds average about 35 minutes in the tank which has a sodium chloride solution consisting of 21.6 per cent.

Richey remarked that production personnel were able to get a "natural" color desired (rather than extreme white) by maintaining the brine solution temperature at minus 5 F. Final freezing was in the blast tunnel where a good combination of air movement and low temperature (range of minus 20 to minus 40 F) is employed. Birds are moved promptly from immersion tank after boxing into the blast freezer. Salt costs quoted were one mill per pound of frozen product. Labor costs and yields were the same as those previously obtained with air freezing.

With post type or full telescope style boxes with the lids open, Richey said the company usually finished freezing turkeys solid within 5 to 7 hours. Using a full telescope box with the lid closed, it takes 10 to 12 hours. Either way they are able to keep the bright color the turkeys have when they come out of the immersion freeze tank. They had some problems at first, mainly with bag breakage, which was largely overcome by more care in handling. They also found the bag must fit the carcass tightly in all areas. Otherwise there would be some patches without the good bright color. All in all the results have been very satisfactory.

Keep It Iced

Ice packed poultry is being shipped considerable distances these days, according to Carl Shaver with the Batesville, Arkansas, firm. He related that more and more distributors are keeping poultry on hand to supply late orders from food stores. Additional time on the road and in the warehouse makes proper, adequate icing more important than ever.

Shaver remarked that in J. K. Southerland poultry icing operations, first consideration is to get the birds chilled down to the prescribed 40 F before packing. Extra ice in the box isn't going to do much good if the birds haven't been chilled as they should be. Another important thing, according to Shaver, is the kind of ice used—10 F ice will do a much better job than 30 F ice.

He related that a new ice conveyor and box closing machine reduced manpower one third. In addition they were able to do away with the laborious ice crushing and ice scooping stations. The box closer makes it possible to place more ice in the container and the boxes can be closed more uniformly, which helps a great deal in the handling, stacking and shipping. Distributors have a better chance of receiving poultry in top condition. There is less spoilage and fewer re-icing claims.

Buyer Outlines Standards

Poultry and Seafood buyer, Joseph H. Mueller, at Chicago Headquarters of National Tea Co. emphasized six points for the poultry producer to bear in mind for the future. As food retailers, he emphasized the chain store's interest in quality poultry merchandising. Points made were:

1. Direct sales by processors to retailers has been an important factor in bringing Mrs. Consumer better and cleaner poultry. However, there is still a place for distributors who can deliver high quality and accurate weights at handling and delivery costs comparable to the retailer's.

2. In National Tea Company's opinion, good brands from processors with good company grading are preferable to government graded products.

3. More mechanization, automation and simplified methods are needed to lower the costs of processing and handling frozen fryers, and make it possible to increase the production of frozen fryers. If a good percentage of the fryers now sold ice packed could be properly frozen at the processing plant level, it would help stabilize the market to everyone's benefit.

4. The poultry industry needs an economical shipping container that will protect tray packed fryers from being squashed and reduce the weepage which creates such a serious weight loss problem.

5. Now that poultry is such a large percentage of total meat sales, there will probably be a gradual increase in profit taking by retailers, even during special promotions. In the past, successful tonnage poultry sales have been based on below-cost selling, demanding a rigid and precise job of buying, handling and merchandising, yet ending up with no profit for the retailer. This can't continue.

6. Since poultry is no longer the little brother in the meat industry, it must operate on a grown-up basis, controlling quality and weight loss problems and finding ways to promote and merchandise its products that will prove profitable to all.

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All refrigerating engineers are invited to affiliate with the National Association of Practical Refrigerating Engineers, Inc., an educational association, "not-for-profit".

From the President's Desk

Chief Continues Management Appeal

SEVEN years ago a tragedy for one family and their cold storage empire began. That is how the story read in a syndicated column in the Chicago Daily News following the New Year holidays.

Seven years prior to the writing of that article by Tony Weitzel, one of the major refrigerating plants in that city suffered a complete loss of refrigeration one week-end. According to the columnist, when the plant went haywire a fortune in frozen foodstuffs spoiled.

Loss of the stored products eventually resulted in bankruptcy and the building, a very old one, was subsequently condemned. It caught fire on New Year's day. The city finally had to appropriate $20,000 for demolition of the building and now has a lien for that amount against the actual lot or parcel of real estate. For the want of a nail . . . a battle was lost; possibly for the want of a good practical engineer, an empire was lost.

The primary mission for which NAPRE exists is to constantly strive to eliminate the probability of such failures. NAPRE's function is to continuously provide instruction of its members in the proper operation and maintenance of a plant placed in their care. NAPRE members realize that the owners spend a great deal of money for equipment to have their plant operated efficiently. Members are cognizant of their obligation to assist the owner in deriving greater dividends, and their contribution is a properly maintained plant.

Asks Local Support

Last month this column suggested that management could encourage NAPRE efforts by attendance now and then at NAPRE Chapter meetings. Further, owners can promote their own interests by encouraging their engineers to become members and actively participate. This month let's carry the idea a step further:

The ideal situation would be for management and engineers to communicate with one another. Apparently there is room for improvement in this respect, at all engineering levels. Recent reports from the National Society of Professional Engineers, based on a survey, indicated that this was a weak point in operations. Title of the report was "Career Satisfactions of Professional Engineers in Industry". Although the report dealt primarily with professional engineers, it did imply that the same yardstick would measure up similarly in operating, maintenance and service fields. Management, according to the report, should keep their engineers informed, and ask for their ideas on relative matters, identify their names with their work and show how their work fits into the total picture.

Frank L. Chase

Quite a number of NAPRE members who are now owners and managers of corporations, and many professional engineers, got their start through NAPRE. They have continued to be an influence in the Association. However, there is room for more counseling and moral encouragement from management. Therefore the invitation is again extended. Owners, operators and managers of refrigerating enterprises are welcome as industrial members of NAPRE. It is suggested that they contact the local chapter or the national office with regard to participation in this foster or paternal type of NAPRE membership.

Herr Does It Again

Readers are possibly beginning to think that Los Angeles chapter has a monopoly on the report pages of INDUSTRIAL REFRIGERATION. This is not the case. Although they do have a very successful speakers program year in and year out, they also have a very methodical, thorough-going reporter in Fred Herr. An earlier report of Herr's has been converted to a full fledged feature and will be presented in an early issue of INDUSTRIAL REFRIGERATION. It deals with a plant visit. The plant provides utility refrigeration to a fresh milk processor on one side, and an ice cream manufacturer on the other.

Frank L. Chase

J. Engalitcheff, Jr.

Theory and Application—

Water Conservation Equipment

»» OVER-BURDENED drainage facilities and decrease in water supply, coupled with the increased demand for water, has resulted in practically a mandatory use of water conservation equipment, for refrigeration and air conditioning systems especially.

Oldest and most reliable method of conserving water is the use of the evaporative cooling principle. In the old-fashioned, so-called "Once Through System", the heat rejection depends solely on sensible heat rise of the water. Hence, in this type of system, assuming an average heat rejection of 15,000 Btu/hr/TR and a water temperature rise of 20 F, the water requirements would be 750 lbs. of water/hr/TR.

In systems using evaporative cooling, the water, instead of being thrown away, is recirculated and after being heated, it is brought in contact with air where it is cooled by evaporation. After being cooled, it is recirculated back through the condenser to pick up heat.

Presented at the Annual Meeting of the National Association Practical Refrigeration Engineers, Inc. at Chicago on November 19, 1957.

Latent heat of evaporation is approximately 1,000 Btu/lbs. of water. Consequently, to extract 15,000 Btu, it would require 15 lbs. of water/hr/TR. On a system using evaporative cooling, it would theoretically require 1/50 of the water required by the "Once Through System". In practice, due to carry-over, blow-down, etc., the evaporative cooling requires approximately 4 to 5 percent of water that is required by the "Once Through System".

John Engalitcheff, Jr., president of Baltimore Aircoil Company, is a graduate of John Hopkins University, with a degree of B.S. in Mechanical Engineering. He is a member of ASHAE and ASRE of which he is a Director. He is a representative of ASRE to ASA on Industrial Cooling Tower Committee-B76, and is also a representative of ASRE on the National Water Policy Panel of EJC. He is an active member of Air Conditioning and Refrigeration Institute, and is a member of the Technical Advisory Committee on Evaporative Cooling, ASHAE.

Oldest type of evaporative cooling is the cooling pond; then came the spray pond; and then the atmospheric cooling tower. Disadvantage of all these systems is that cooling demands on the wind velocity. Consequently, their performance was not dependable. Furthermore, they were extremely bulky and suited only for outdoors.

The next step was the development of mechanical draft towers. Fig. 1 shows a schematic arrangement.

In the mechanical draft tower, air circulation depends on mechanical means. Consequently, its performance is not influenced by wind velocity. Moreover, as time progressed, the designs have been improved with the consequent reduction of space requirements per TR. Also, having mechanical means of circulated air, it becomes possible on smaller jobs, to install these towers indoors.

Early in the '30's, an evaporative condenser came into being as shown in Fig. 2. An evaporative condenser is nothing more than a combination of a condenser and a cooling tower in one piece of equipment. All that was done is that the fixed surface

(Continued on Page 26)

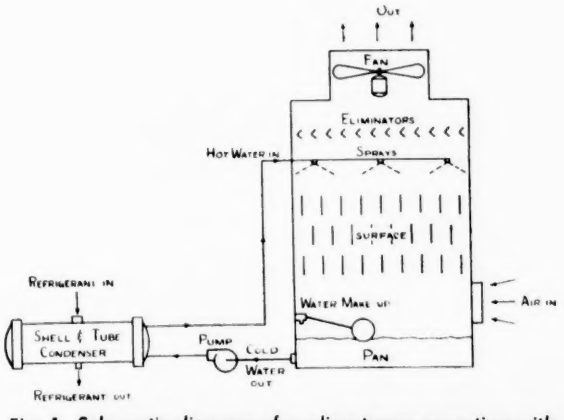

Fig. 1—Schematic diagram of cooling tower operating with shell-and-tube condenser.

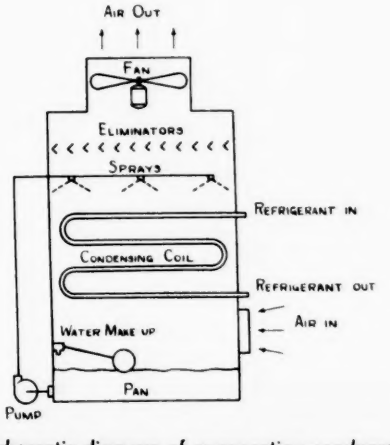

Fig. 2—Schematic diagram of evaporation condenser showing conventional arrangement of major components.

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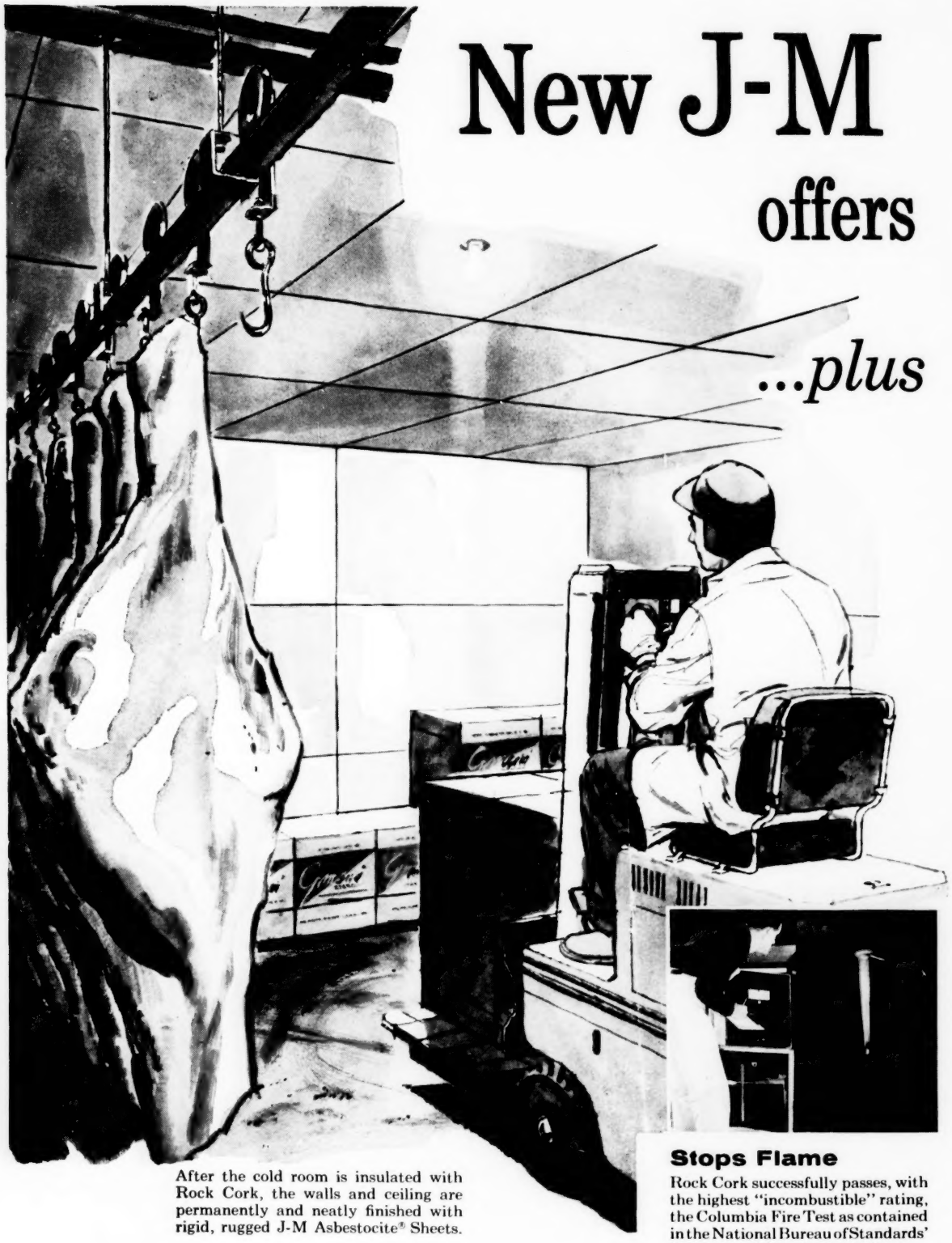

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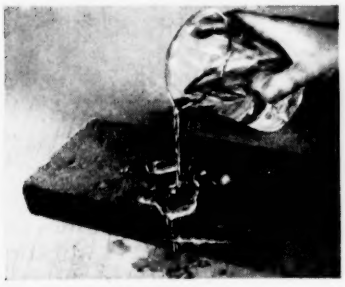

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(Continued from Page 23)

of a cooling tower was replaced with a condensing coil. This created an extremely compact and efficient piece of water conservation equipment. Basically, both pieces of equipment are identical in principle depending on evaporative cooling.

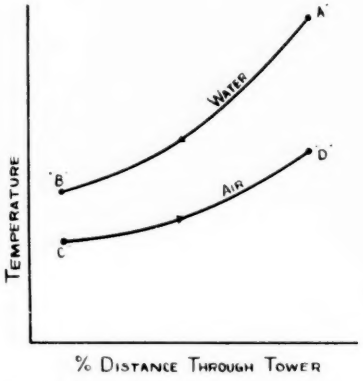

Fig. 3—Temperature relationship between water and air in a counter flow tower.

Relationship between water and air as they pass through the cooling tower is shown in Fig. 3. Comparatively, the relationship between refrigerant and air in an evaporative condenser is pictured in Fig. 4.

Evaporative Performance Not Dependent Upon RH

Without going into details, the air path as it passes through an evaporative condenser or a cooling tower can be assumed, for this discussion, as shown in Fig. 5. This illustration clearly indicates that the performance of an evaporative type water conservation equipment is influenced only by the wet bulb of entering air and does not depend on the relative humidity at which the air enters.

Air Cooled Condensers Dependent Upon 30 F TD

In recent years, there has been a tendency and development of air cooled condensers for larger installations. The increase in popularity is mainly due to the simplicity of installation and operation. However, due to economics, the air cooled condensers are usually designed on a 30 F TD plus the fact that they are dependent on ambient dry bulb temperatures, temperatures during the hot weather.

High condensing temperatures during hot weather in turn result in an appreciable increase in bhp, paralleled with a drop in capacity of the system when it is mostly needed. Consequently when designing a system using an air cooled condenser, all components should be correspondingly increased to provide full capacity under ambient conditions.

Condensing System Selection

A very common question asked is: "Which system should be used—an evaporative condenser or cooling tower?"

There is no cut and dry answer. Each has its advantages and disadvantages and each installation has to be judged on its own merits and requirements. In general, it can be said that the evaporative condensers are more advantageous:

1. On new installations of central type, when one or more compressors are located adjacent to each other.
2. On the conversion jobs when water cooled condenser surface has to be replaced.

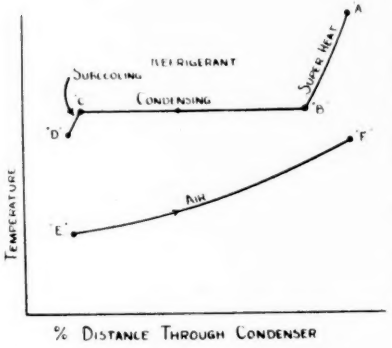

Fig. 4—Temperature relationship between refrigerant and air in an evaporative condenser.

3. On any year-'round operating system. In the majority of this type of systems, as the temperature drops to freezing, the evaporative condenser can be operated dry, thus eliminating the problem of freeze-up which is encountered in cooling tower installations.

Cooling towers are more advantageous:

1. On conversion from a once-through system whose water cooled condenser is in good condition, and does not need replacement.
2. On any installation composed of a large number of small scattered systems where it becomes a problem of interconnecting and carrying of discharge and liquid lines.
3. On small systems where self-contained factory-assembled units are used.
4. On centrifugal type refrigeration systems.
5. On the absorption type systems.

Installation and Control As Important As Sizing

In the selection of water conservation equipment, caution should be exercised in the selection for a maximum load under maximum conditions. In the once-through system, there is a natural built-in safety factor in unlimited water supply which offers flexibility in capacity by merely changing the amount of water passed. In water conservation equipment, the capacity is fixed and cannot be easily altered should the need arise. In this respect, however, it should be emphasized that the equipment should not be over-sized.

One of the larger factors influencing proper performance of a job is the proper installation and control. The cooling tower installation is simple enough and the only point which should be considered in installing a cooling tower is that the discharge air is free to dissipate, and therefore, there would not be any recirculation.

In an evaporative condenser, beside the dissipation of air, the very important factor is the manner in which refrigeration piping is connected. Proper piping arrangement for a single evaporative condenser installation is shown in Fig. 6.

Two evaporative condensers in parallel are sketched in Fig. 7.

Fig. 8 shows an evaporative condenser with Shell-and-tube condenser in parallel operation.

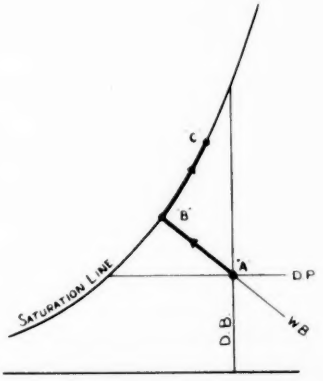

Fig. 5—Psychrometric analysis of air path through an evaporative condenser on cooling tower.

Condensing Pressure Control

For year-'round installations, on either evaporative condensers or cooling towers, it is advisable to install an auxiliary water tank located below the unit in a heated space as shown on Fig. 9. This is the simplest method to prevent freezing. With an evaporative condenser, during freez-

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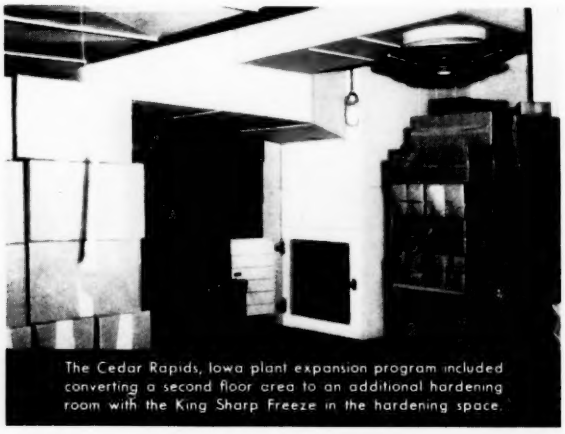
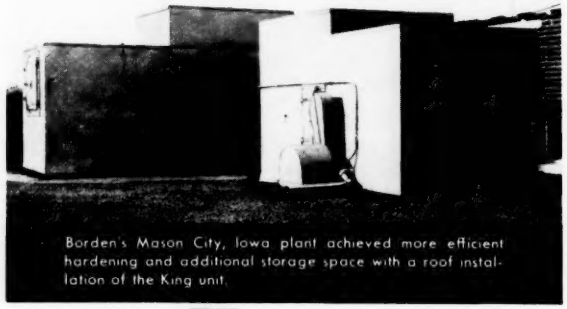


The Cedar Rapids, Iowa plant expansion program included converting a second floor area to an additional hardening room with the King Sharp Freeze in the hardening space.



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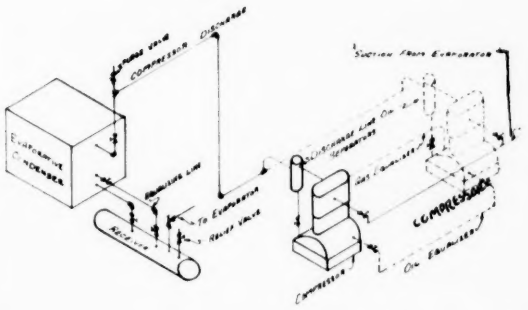

Fig. 6—Single "evaporative condenser" with one or more compressors.

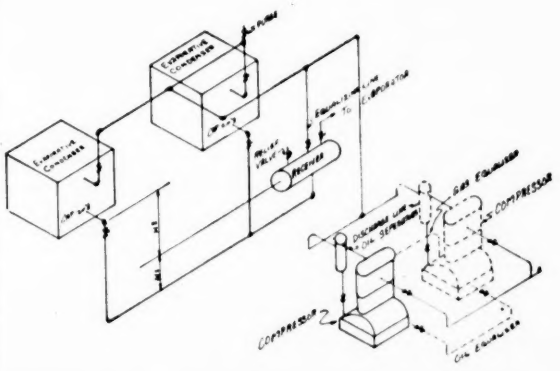

Fig. 7—Paralleling evaporative condensers (any size) with one or more compressors.

ing weather, it will more than likely be operating dry, but for in-between seasons, it provides instantaneous water supply of spray water if the need arises during a warm spell.

This brings up the question of condensing pressure control. In any air conditioning and refrigeration system, there is a minimum head pressure. This head pressure should not be allowed to drop below the minimum, so that a pressure differential across the expansion or float valve is maintained to assure sufficient liquid flow for the load.

On evaporative conservation equipment, the capacity, and consequently the head pressure, depends on the wet bulb. Therefore, on some installations such as air conditioning with great variable loads, or on installations which operate throughout the year, some method of condensing pressure control is necessary. There are many such systems available, but consider the ones which are the simplest as well as the most satisfactory.

Evaporative Condenser Controls

First consider the evaporative condenser. The simplest method of condensing pressure control is one of cycling of water circulating pump by the head pressure switch. This is the simplest and cheapest method and is claimed to be patented. This method produces a very uneven and jagged pattern of head pressure. Besides, unless the condenser produces a substantial amount of sub-cooling, it is bound to produce re-evaporation and flashing in the

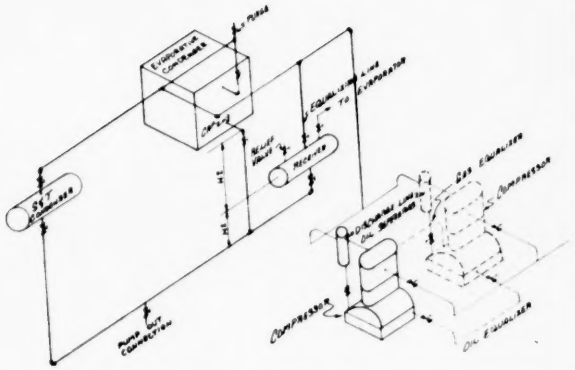

Fig. 8—Paralleling an "evaporative condenser" and a "shell-and-tube condenser" with one or more compressors.

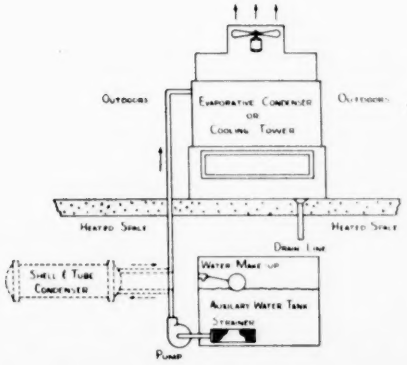

Fig. 9—Remote pump and auxiliary tank arrangement on an evaporative condenser or cooling installation for year-round operation.

liquid line. This flashing occurs right after the pump is cut-in and further contributes to erratic operation. The schematic diagram of the system's operation, as the pump cycles, is shown in Fig. 10.

On cooling towers, the simplest and cheapest method of control is to bypass the water around the cooling tower proper. This method produces the same fluctuating head pressure as on the evaporative condenser, and in addition this method may result in freeze-up of a tower under winter conditions.

Air Outlet Damper Control Controls Discharge Pressure

Most economical and adaptable method for both evaporative condensers and cooling towers is a modulating damper installed on the air outlet as shown in Fig. 11. The damper is operated by a modulating pressurestat in the refrigerant discharge piping. The damper method produces very even head pressure. Furthermore, when installed on an evaporative condenser, it continues to function during the winter when the condenser is operating dry, thus giving very satisfactory control year-'round.

When dampers are installed on an evaporative condenser, care should be taken that when the dampers are throttled, they should not alter the air distribution over the face of the coil.

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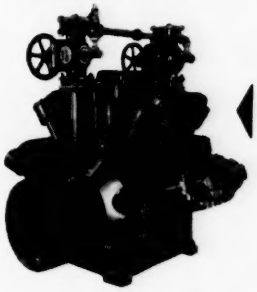

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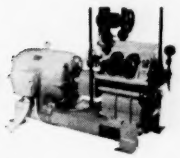

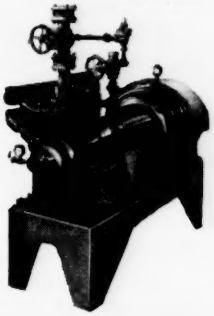

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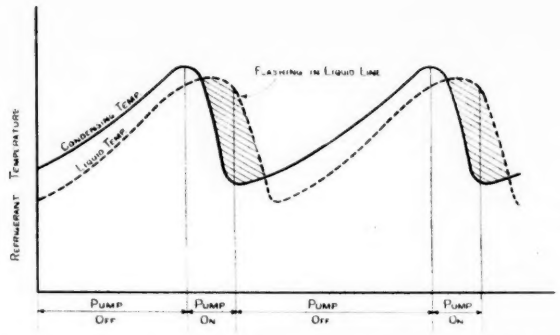

Fig. 10—Variation in condensing temperature and liquid refrigerant temperature when evaporative condenser pump is cycled for capacity control.

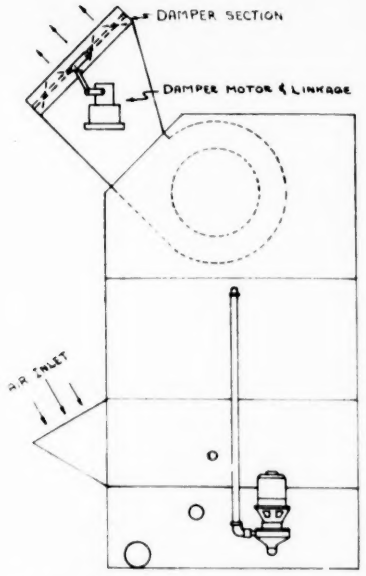

Fig 11—Schematic diagram of evaporative condenser or cooling tower using dampers for capacity control.

Equipment Material Choice

In evaporative water conservation equipment, extreme care should be used in selecting proper materials. There is no ideal material, but some are more preferable than others. For instance, wood as cooling tower fill has the advantage of being relatively inexpensive, and is not subject to corrosion. However, wood is subject to rot, and it is combustible, creating a fire hazard. Even more serious—wood warps, thus affecting water distribution with consequent loss of tower performance.

Of late, plastic fill has gained some acceptance. The advantage of plastic is its lightness, and comparatively low first cost. Unfortunately, however, today's commercial plastics are combustible. Also, because of their lightness, they have no structural strength. Heavier weight material can be used but then the price becomes prohibitive.

Steel fill offers many advantages. It is fireproof, it does not warp, and thus performance of a tower is always the same irrespective of its age. With proper protection, steel's life is at least equal to other materials. However, steel, especially when properly protected, is more expensive than wood or plastic.

Corrosion Cautions

In evaporative condensers the use of similar materials is desirable to prevent electrolytic action. Some people feel that the copper coil with a galvanized casing is the answer. However, this is a fallacy. True enough, the copper coil will last for a long time. However, with the presence of moisture, as is in evaporative condensers, an electrolytic action is set up between copper and zinc. Zinc being of lower potential is a sacrificial metal and is removed from the galvanized surface of the unit, thus exposing the steel which easily corrodes. The copper coil in the meantime remains intact.

The proper approach is to use all similar metals such as galvanized coil with galvanized casing.

Many specifications call for stainless steel parts. Actually this provides no advantage. Stainless steel, being of a high potential, will attack zinc just like copper will. Then after the black iron is exposed, the potential is reversed and the black iron attacks stainless steel. Should it be necessary to use dissimilar metals in construction of evaporative cooling equipment, then a unit should have an anode of a sacrificial metal of a lower potential than any other metal in the unit. Thus it will be sacrificed, rather than the metal which was used for the construction of the unit.

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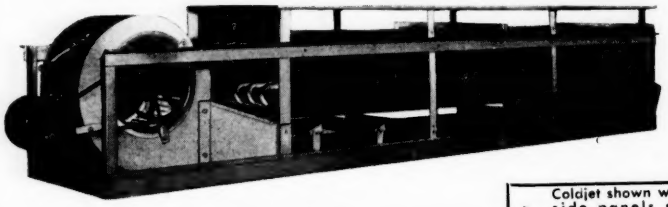

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NAPRE Question Box

H. P. Hayes

HAVE A QUESTION? Address it to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif. Answers appear monthly in this department on problems forwarded by NAPRE members. Comments from all readers welcomed.

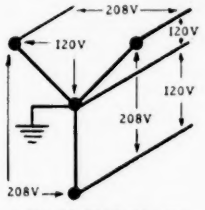
Grounds for Discussion

QUESTION: In our area we have a power supply from a three-phase 480 volt secondary. The secondary is not grounded. We show no voltage to ground from either conductor except varying voltage that may be due to induction between the conductor and conduit. The power company tells us this is quite normal.

Quoting from a recent article by a power engineer, "It must be realized that even on an underground 3-phase system there exists a normal voltage to ground, each phase which is 58 percent of line to line voltage. Can you explain this discrepancy?

—C. G., Bakersfield, Calif.

ANSWER: There is probably no discrepancy in the article which you read with the condition which you find in your building.



3 PHASE STAR OR "Y" TRANSFORMER

Connecting a voltmeter between the terminal of an un-grounded three-phase secondary and the ground does not close the circuit. To close the circuit you would need to ground one of the other terminals.

The article which you read probably dealt with a three-phase transformer having a "Y" arrangement of secondary coils with a grounded common center junction to the three coils. The voltage from any one of the three terminals to ground would then be approximately 58 percent of the voltage between the terminals.

—H. P. Hayes

Understanding Oil Mixes

QUESTION: What is meant by the miscibility of oils? I see reference to this often, yet do not clearly understand what it is and why it is important?—D. W., Chicago.

ANSWER: In refrigeration systems "the miscibility of an oil" means its solubility in a refrigerant.

Oil refrigerant solubility varies with the type of oil, the type of refrigerant and the temperature of the refrigerant-oil mixture. The greatest of these three factors is the type of refrigerant. Most oils are completely miscibile with Refrigerant-12 at temperatures above 0 F but may have limited solubility at lower temperatures. With Refrigerant-22 there is a definite change from complete miscibility at the higher temperatures to very limited miscibility at the lower temperatures. The temperature at which the separation occurs will depend on the type of oil, occurring at a much lower temperature with the napthenic base oils than with the paraffinic base oils. The miscibility of oil in ammonia is low at all operating temperatures.

Because of the high miscibility of oil in Refrigerant-12 oil is circulated throughout systems using this refrigerant. The piping system must be designed so that oil will not trap out but will return to the compressor crankcase.

In Refrigerant-22 systems an oil with high miscibility at condensing temperatures must be used or it will separate above the refrigerant in the receiver.

Because of the low miscibility of oil in ammonia, systems using this refrigerant are designed not to circulate the oil through the system. Suitable drains must be provided to drain oil at any point where it may collect below the liquid refrigerant.

—H. P. Hayes

Thermocouple To Thermistor

QUESTION: Someone told me recently that thermocouples are "old-fashioned" and that the latest thing is the thermistor. What is a thermistor and how does it work?

—C. P., Los Angeles

ANSWER: Thermistors are a new type of electrical-resistance thermometers. They are ceramic bead mixtures of metallic compounds with negative coefficients of resistivity (as temperature increases, resistance decreases). Their coefficients of resistivity are about 10 times that of metal wires. Therefore, they are much more sensitive to temperature change than ordinary resistance bulbs.

—R. R., San Luis Obispo

X-ray Weld Inspections

QUESTION: Can you publish an X-ray picture of a weld and give some pointers on how to interpret? I know that weld inspection is becoming increasingly more important and would like to know how to read the pictures.—C.L., NYC.

ANSWER: X-rays and gamma-rays are a form of radiant energy with the ability to penetrate metals and opaque objects. X-rays are generated by an X-ray tube; gamma-rays by radioactive isotopes. An X-ray photograph or radiograph is produced by the passage of X-rays or gamma-rays through the object and recorded on film. There are certain dangers to personnel involved in the use of X-ray and gamma-ray.

Now if the object under consideration is a weld having various defects, as noted below, there is a reduction in the total thickness in the weld, in the areas of the defects. Therefore more rays will pass through the part containing the discontinuities or voids than through the adjacent metal. A darker spot will appear on

the film when developed. This indicates a lack of thickness.

Radiograph then is a kind of shadow picture, the darker regions being more penetrable and the lighter regions more opaque. The nature of defects found in welds and recognizable in radiographs are as follows:

1. *Gas inclusions* occur as round dark spots. Gas inclusion is usually spherical in nature and are not considered too harmful provided they are not too big and are not concentrated or in too close an alignment (see ASME Code for unfired pressure vessels for acceptability rating).
2. *Cracks* appear as dark irregular lines, usually easy to identify. No two cracks can be allowed in any weld. They can be transverse to or lengthwise with the weld.
3. *Slag inclusions* appear as dark, irregular areas on the film. Parallel lines of slag in multi-pass welds where the slag has not been properly cleaned are called "wagon tracks". Some slag inclusions may be allowed depending upon the governing code. However, being irregular in nature, they can be crack starters and should be discouraged.
4. *Lack of penetration* usually appears as a straight line. The plate edges are not fused. What is seen is actually the edge of the plate. Here again the amount allowable is dependent upon the governing code. Usually, lack of penetration is not acceptable.
5. *High-low*: Plate edges are not in the same plane, usually found in pipe welding; similar to lack of penetration appearing as a straight line. Rather hard to interpret without considerable experience.
6. *Burn Through*: The welder burned through to the other side of the plate, making a small crater which is thinner than the plate—and appears as a dark irregular crater-like spot on the radiograph.

—R. W., San Luis Obispo

Selecting Pipe Materials

QUESTION: There are so many new piping materials on the market that it becomes more difficult to make a selection. Will you outline factors to consider in selecting materials for piping?—C.D., Pittsburgh, Pa.

ANSWER: There are no fixed rules for the selection of piping materials. Some of the more important points to consider are:

1. Intensity of fluid pressure.
2. Suitability of material to withstand internal and external corrosion.
3. Friction coefficient and coefficient of expansion.
4. Local availability of material especially fittings.
5. Flexibility in regard to application.
6. Rigidity with respect to supports.
7. Material Cost.
8. Installation labor cost.
9. Ease of repair.
10. Life expectancy compared to amortization.
11. Collapsing resistance.
12. Resistance to shock and vibration.

—J. H., San Luis Obispo

Engineering Economics

QUESTION: Will you do a sample problem to show how the "cost of money" enters into comparing which of two systems to use? How can I determine whether to use a system of high initial cost and low operating cost, or vice versa?

—E. R., Chicago

ANSWER: Consider the following two systems and determine which an owner would install.

System Lifetime Comparisons

	System 1	System 2
Initial Cost	$10,000.00	$4,000.00
Life	10 yrs.	10 yrs.
Salvage Value	0	0
Yearly Oper'g Costs*	$1,000.00	$3,000.00

* Includes maintenance and service, as well as power, water, etc.

System 1 depreciates at the rate of $1,000.00/year.

System 2 depreciates at the rate of $400.00/year.

If an owner borrowed the initial capital, assume he would probably pay 6 percent yearly interest. (If he uses his own money, he should still charge himself 6 percent in analyzing the investment).

Average interest payment per year over the 10 year period is found by the formula:

$$\text{Av'g Interest} = \frac{\text{Prin'p'l x Int. Rate (no. of yrs.)}}{2\text{ (no. of yrs.)}}$$

System 1, Avg. Int. = $330.00/yr.
System 2, Avg. Int. = $132.00/yr.

Comparison of Costs

	System 1	System 2
Depreciation	$1,000	$400
Interest	$ 330	$132
Operating Expenses	$1,500	$3,000
Totals/yr	$2,830	$3,532

Conclusion: System 1 is a better investment.—**H. P. Hayes.**

DISTILLED WATER?
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DISTILEX
Distilex renders raw water the same as distilled water for ice making, and increases tonnage production by decreasing the number of hours required to freeze untreated water.
Distilex, safe and easy to use, prevents white butts, and eliminates cracking while ice is being frozen, dumped or cut. Economical—Distilex costs less to use than cracked bar losses.
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NEW QUESTIONS

Discharge Temperature?

QUESTION: What should the discharge temperature be with 25 psi suction pressure and 165 psi discharge and 50 F suction temperature at the NH_3 compressors?—L.H.B.

Where Do We Put The Machinery

QUESTION: Is there any rule of thumb for determining how much space should be provided for in a building so that there is plenty of area for the equipment room? We are planning a new office building and would like to be able to guess in advance what our machinery room (air conditioning) requirements will be.—S.W.B., St. L., Mo.

Piping Field Test

QUESTION: How do you field test piping under conditions imposed by Pressure Piping Code, ASA B-31.1, 1951, when relief devices furnished on low pressure vessels are set at 150 psig? Don't want to risk lifting reliefs with subsequent leaks of the refrigerant, etc.—W.V.R., Libertyville, Ill.

Discharge Temperature With Clearance Volume

QUESTION: What is the effect on discharge temperature of clearance volume in VSA ammonia compressors?—E.E., Australia.

Fluorescent Heat Loads

QUESTION: Last year in a Chicago Chapter meeting we worked out a practical problem on air conditioning where a factory building was illuminated with fluorescent fixtures. The instructor used a Btu figure based on 40 watts per tube. I maintained that two 40 watt tubes and ballast would be the equivalent of 100 watts incandescent lighting. I bowed to the consensus of those in attendance.

Now, however, I see in "Science and Appliance" that a "standard 100-watt fluorescent unit contains two 40-watt tubes and ballast, is said to yield more than three times as much light as a 100-watt incandescent bulb. That still leads me to believe that my original contention was right. However I need an authority. Can you point one out?—H.R., Chicago.

Metering Ammonia

QUESTION: We are contemplating a liquid ammonia meter to measure refrigeration supplied to another business. We are using yearly averages to figure this and we are not sure of gallons of liquid ammonia per ton of refrigeration. Our average temperatures and pressures are: Liquid ammonia 70 F; back pressure 18 psig; condenser pressure 130 psig. Any ideas will be greatly appreciated. A.R.B., Caldwell, Idaho.

Slug Backs

QUESTION: What causes slug backs in an ammonia plant equipped with recirculating systems? Specifically this occurs when a sudden heat load is put in the cooler or freezer. Apparently more than enough ammonia is circulated to cause the liquid receiver to carry over, or to recycle the system, or in some cases to kick out the entire system when it is needed most.—F.D., Denver.

Corrosion

QUESTION: What can be done to stop corrosion of an aluminum jacketing on our insulated lines? Insulation is Foamglas, but the corrugated jacketing was applied by the contractor using stainless steel bands. At first we believed the corrosion was due to the brine spray coils used in our cooler areas. However, in our freezer storage where

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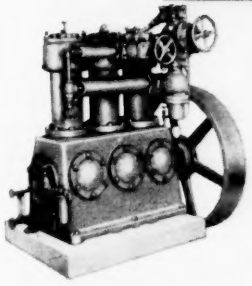
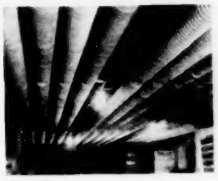


HOWE COMPRESSOR DS-26
Sizes: 25 to 50 tons



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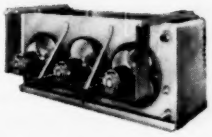
The new RAPID FREEZE units are especially designed for blast freezing and freezer storage of all kinds of food products.



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we use dry coils the same effect takes place although at a slightly reduced rate. Where the band is applied seems to be the point of most rapid corrosion.—D.C., Dallas.

High Super Heats

QUESTION: Our plant has experienced considerable difficulty with the compressors used on a portion of the plant where we take the direct suction on high temperature rooms located at some distances from the plant. High super heats are encountered with the discharge temperatures running as high as 325 to 350 F. Other compressors in the same plant which take suction from the flash tank run considerably cooler. No valve trouble or scoring is experienced with the latter compressors, while it is quite repetitious with the former.—L.J.V., Birmingham, Ala.

Refrigerant Decomposition

QUESTION: What is the critical point of ammonia? If L.J.V. above is operating at 350 F, is not his ammonia decomposing? Will the average purger remove sufficient quantities of inert gases which result when ammonia decomposes to prevent any disastrous consequences?—F.L.G., Decatur, Ga.

Brine "Cleaning"

QUESTION: Having always been an operator of direct expansion refrigerating plants of medium tonnage, and being on a new job, I was non-plussed the other day when my plant owner asked if I intended to "clean the brine system and restrengthen the brine for our coming busy season". How does one go about "cleaning" a brine system and where can you find literature on the maintenance of calcium brine?—T.W.J., Dallas

Ice Rink Problem

QUESTION: Our open air ice skating rink located in one of the suburbs north of Chicago, is often affected by direct sunlight. One of our customers indicates that a Rocky Mountain rink uses a unique shading system. Can you tell us where we might learn of this? Is there any refrigerating practice we can use to offset softening of the ice on days of strong sunlight other than shading?—J.J.R., Chicago.

Oil in Evaporator

QUESTION: I am operating a Refrigeration-11 centrifugal compressor. I have added a lot of oil to maintain my oil level and I believe it is all going over and staying in the chilled water evaporator.

Is there any way to tell how much oil is in the liquid refrigerant in the evaporator?

What amount of oil will affect operating conditions?

How can I get this oil out of the evaporator?—N.M.D., Chicago.

Reflective Insulation

QUESTION: Insulation recently applied to an addition to my cold storage plant went over sheets of aluminum for exterior walls and under similar sheets for the roof. I applied the aluminum foil not only for its vapor barrier values but for reflective characteristics as well.

Later when I built a new home I tried to persuade my contractor to do the same. He argued that this practice had very little value in home construction and quoted me an exorbitant price when I asked him to investigate. Yielding to an expediency at the time, I have since felt that perhaps I should have put the time and effort into placement of aluminum foil or reflective surface inside my fibrous insulation materials in my new home. Do you agree?—B.C.M., Toledo.

News Notes and Chapter Activities

Fruit Belt NAPRE Group Elects, Then Tours Cannery

BENTON HARBOR—At a recent meeting an election of officers of the Fruit Belt Chapter was held. Directors elected by ballot were Tom Dewhirst, House of David Cold Storage; Dorr Dean, Silver Mill Frozen Foods, Inc.; Lloyd Phillips, Michigan Fruit Canners, Inc.; John Pfauth, Dwan's Home Canning Co.; William Knowlton, Sodus Fruit Exchange; Robert Carpp, Lawrence Frozen Foods Co.; and Hugh Bengtsson, Producers Service Corp. Directors held a meeting later and elected their officers as follows: Tom Dewhirst, president; Lloyd Phillips, 1st vice-president; John Pfauth, 2nd vice-president; Dorr Dean, secretary-treasurer, and William Knowlton, sergeant-at-arms.

It was duly moved and the motion carried that the Fruit Belt Chapter would meet regularly on the second Thursday of each month. The late F. T. Brandt talked to the group on the fundamentals of refrigeration. Brandt had encouraged the Chapter formation and made the trip from Chicago, his home, to get the first educational meetings under way. Following the meeting, a tour was made of the Michigan Fruit Canners Refrigeration and freezing plant.—H. THOMAS DEWHIRST.

Rocky Mountain Chapter Initiates 1958 Program

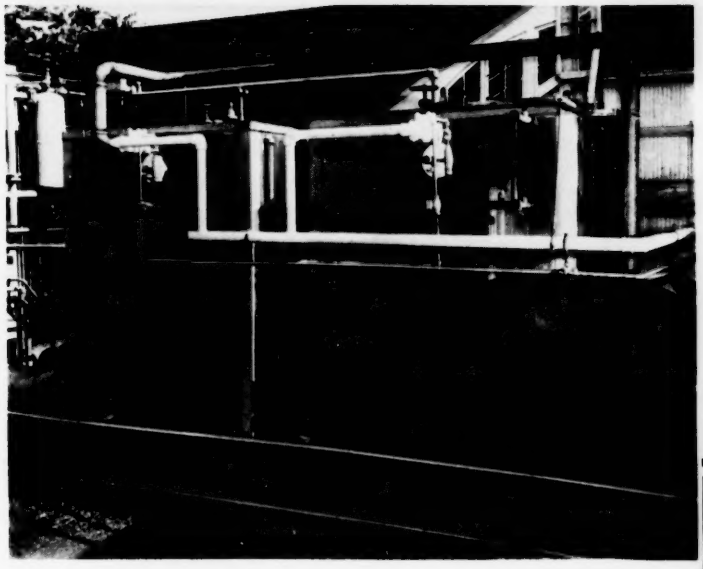
DENVER—Chicken dinner, courtesy of and through the cooperation of the chapter membership, opened the January meeting, the first of the new year. New officers were elected at that meeting and Ray Doyle, district manager of Styro Products, Inc., was the featured speaker. Election of new officers saw Mike Bistranin, president for two years, succeeded by John Rohrs. Mike was a fine leader and an excellent instructor and his service will be missed. Denver didn't have a chapter until 2 years ago and members credit Mike for starting the chapter and bringing it to where it is today.

Bistranin was promoted from chief engineer at the Safeway Distribution Center to Refrigeration Supervisor over all the Safeway Stores in the Rocky Mountain region. Mike, with his new job didn't feel he could give the local chapter what it needed in leadership and therefore declined the 3rd term. His job often takes him to other parts of the state and surrounding states. John Rohrs, new chapter president, like Bistranin, got his start with Rocky Mountain York until last year when he started a refrigeration business of his own, which is called Temperature Engineering Co.

Al Nazarenus, first vice-president, was succeeded by Gerald Hoekstra. Nazarenus declined another term on the basis of present job pressures. He has been with Beatrice Foods for over 10 years and is chief engineer of the Denver installations. Earl Burger, an engineer at Maddox Ice Co. succeeds Dean Binkley as 2nd vice-president. Binkley is assistant chief engineer for Beatrice Foods and has 20 years service with that firm.

Frank Didonato took over Marcus Florida's and Gerald Hoekstra's job as secretary-treasurer, which position requires much time and work and merit. Frank was just the man. He is now chief engineer of the Safeway Distribution Center. Kenny Doyle, an engineer at Wilcox Packing, is the new Sergeant-at-Arms. He succeeds Chas. Beals, an engineer at Beatrice Foods.—GERALD HOEKSTRA.

The "King Zeero" affords SPEEDY - LOW TEMPERATURE LOW COST Product and Air COOLING



Two Model 610 "King Zeeros" connected in series and installed outside of Plain View Farms, Louisville, Ky. (Note frost on suction line to compressor.)

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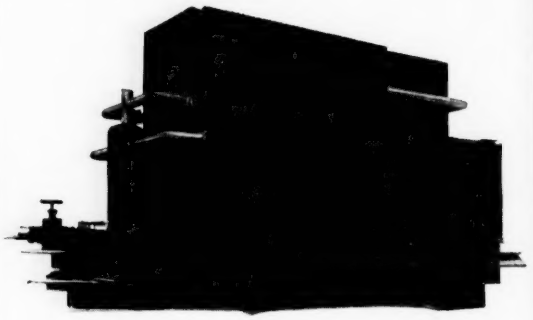

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John Mariakis

Members-at-Large Proud of Installations

SELDOM does a member-at-large have the opportunity to show off his plant as happens in the local chapters of NAPRE. A certain number of plant visitations take place in the chapters and sooner or later the engineers with any particular firm have an opportunity to show off a plant that is their major working interest.

Through this column, however, our members-at-large have the opportunity to give NAPRE members the world over an opportunity to come into their establishments for a visit. One such a letter was received recently from Edward Butts, chief engineer, Columbia Ice and Cold Storage Co., Wenatchee, Washington.

Refrigerating plant for the Columbia installation has 1200 tons capacity, according to Butts, of which 500 tons is 2-stage used in freezing and storing frozen foods. The firm does freezing for Cedargreen Frozen Pack, amounting to approximately 12 million pounds per year. Storage capacity is available for 7½ million pounds of frozen foods. Other freezing activities are confined to manufacture of ice for wholesale, retail and industrial sales.

Expanding Produce Area

Ice production at Columbia amounts to a maximum of 200 tons daily which is for the most part supplied to the Great Northern Railroad. Wenatchee is located in a valley that produces from 15 to 20 thousand cars of fruit per year. High temperature storage for apples is therefore provided, amounting to 135 carloads. Items frozen in the plant consist mainly of asparagus, peas, peaches, corn, lima beans, carrots, squash, and french fried potatoes. These commodities are grown, for the most part, in the rich newly developed Columbia Basin area, made possible by irrigation from Grand Coulee Dam.

Operation at Columbia Ice and Cold Storage is on a 24-hour basis with three operators each having an 8-hour work day. Butts is the chief engineer of the plant having been appointed to that position on November 10, 1955. He credits his contact with NAPRE and eventual membership to Frank Knowles, Belt Ice Co., Seattle.

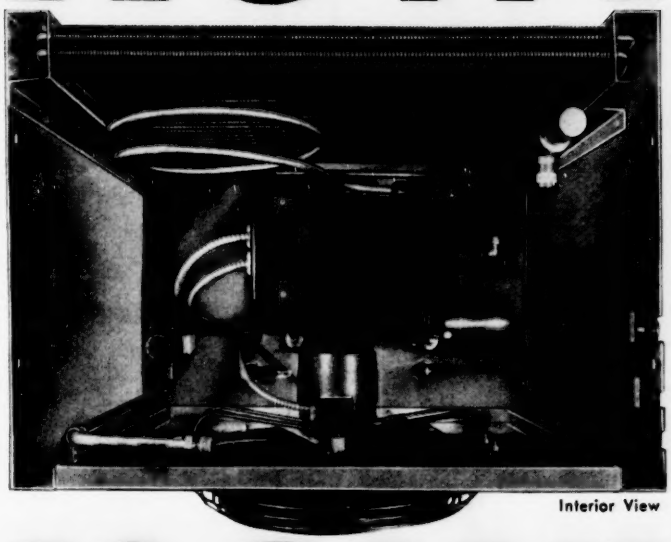
Although Butts has been interested in a NAPRE chapter starting in his area, it has been difficult since most of the other refrigeration plants are for private warehousing interests. Since these warehouses are apple storages and the storage is of seasonal nature, many of the plants are automatic and those which are not generally employ a migratory engineer. Yakima chapter is a little too far removed for reasonably good travel conditions. In concluding his remarks about the plant, of which it can be seen that Butts is justly proud, he commented on the official organ. He stated he looks forward to each issue and finds most valuable the articles and illustrations offered to him and his engineers by other NAPRE members and the editorial staff.

Eastern Members Correspond

Other members-at-large submitting data on their plant, included Louis Beach, chief engineer at the Evansville Ice & Storage, Evansville, Indiana. Beach pointed out that their operation is quite similar to the average ice and cold storage operation. His operation involves the use of 12 compressors, six of them being booster, all of one manufacture, while the high side machines consist of three other makes of various vintages. Beach was proud of the fact that he had recently recruited one more new NAPRE member and expressed his appreciation to other NAPRE members for their help and assistance through the years.

Another recent letter received was from past national president, Walter E. Bernd. Walter has been the engineer in charge of construction at a Strategic Air Force base in upstate New York. He was unable to make the NAPRE annual meeting this year due to pressure on the U. S. Engineers Corps to wind up such work.—JOHN N. MARIAKIS

new! new! new! new!



Interior View

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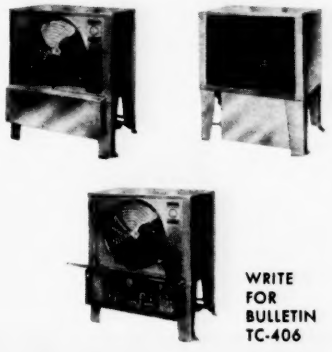

WRITE FOR BULLETIN TC-406

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44 YEARS OF CONTINUOUS ACHIEVEMENT IN HEAT TRANSFER

Early Refrigeration Publication Reviewed at California Meeting

LOS ANGELES—Business and technical discussion yielded to traditional custom for making the NAPRE Los Angeles Chapter's first meeting of the year a gala affair. Only diversion from the social schedule was a period between the close of the dinner and the start of the entertainment features when Larry Benedict displayed an interesting item that had been donated to the Chapter's Refrigeration Museum. It was a copy of a 58-year old book, MACHINERY FOR REFRIGERATION, written by the late Norman Selfe and published in 1900 by H. S. Rich and Co., predecessor to Nickerson & Collins Co., today's publishers of INDUSTRIAL REFRIGERATION.

The book was well-preserved, having been kept through the years in a dustproof cardboard book-holder. Its vintage was apparent, however, from the old-style type and the turn-of-the-century wood cuts used for illustrating text and advertisements. Preceding the title page appears a photograph of Norman Selfe, with a caption identifying him as "Chief Instructor in Art, Sydney Technical College, Sydney, N.S.W., Aust". Clue to the age of the book and the photograph is the tissue sheet which covers the photograph; a practice abandoned by book publishers many decades ago.

How far the refrigeration industry has advanced from the days when William McKinley was president, when the book came off the press, was indicated by examination of the sketches and engineering designs used to augment the articles. Represented among the advertisers in several full and broken pages is the Ammonia Co. of Australia, manufacturers of ". . . liquid anhydrous ammonia and pure aqua ammonia".

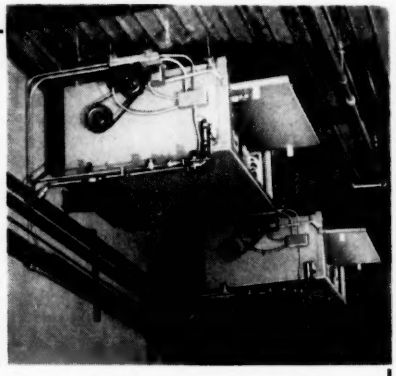
Readers today may possibly remember the names of some of the firm's which advertised in the book —Triumph Ice Machine Co. of Cincinnati; Pennsylvania Iron Works; Herf & Frerichs of Cincinnati and St. Louis; and Newburgh Ice Machine Co. of Newburgh, N. Y. Vilter Manufacturing Co. of Milwaukee advertised ". . . double-action ammonia compressors driven by Vilter-Corliss engines". Present, also in the 1900 volume was an ad by the Frick Co., and York Mfg. Co. which 57 years later carried many prominent advertisements in the 1957 issues of INDUSTRIAL REFRIGERATION.

Donated by Green

Benedict announced that the book had been donated by Ed Green a former employee of the Frick Co. and The Benedict Co., who thought it would make an interesting item for Los Angeles Chapter's Refrigeration Museum.

Ed L. Nelson, the chapter's perennial entertainment committee chairman (he was reappointed for another term following the December elections) presented a diversified program of amusement for the January 15 meeting. Amber tinted liquid refreshments were served free during the social hour. To encourage cultural development of the membership there was, for a fact, some fine music supplied by a vivacious young lady accordianist. The song which was offered in solo, duet, quartette and group form by various fun-loving members, was characterized more by

Partial view of six Krack coolers installed by York Louisville Co.



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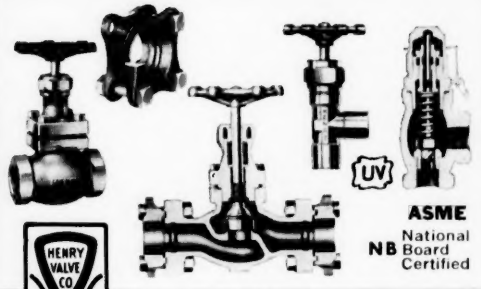

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gusto and enthusiasm than harmonious melody. After the dinner, comic films and a movie showing scenes from a historic pageant held last year in Chicago in commemoration of America's transportation media—horses, pony express, covered wagons, railroads and airplanes, were shown. —Fred Herr.

Louisiana Opens 1958 Term With Officer Dinner-Dance

New Orleans—Chosen to serve Louisiana No. 2 Chapter, NAPRE, for the 1958 term were Joseph Arena, president; Joseph Vernaci, first vice-president; John C. Funel, second vice-president, Harold McGovern, third vice-president; Leo J. Vivien, secretary, Eugene W. Orth, financial secretary; George J. Whitman, treasurer, Marion Olivier, educational chairman, and Joseph DeFraites, Jr., sergeant-at-arms. Elected to serve as Board of Directors were Joseph Copley, Maurice Burch, Edw. Dumaine, Julius Prager and Hollis Havers.

Nearly 250 members and guests of Louisiana No. 2 Chapter gathered in the Walnut Room of the New Orleans airport terminal building, Saturday evening, January 11, for the annual dinner-dance at which the Chapter's newly elected officers were installed. Frank L. Chase, National President of NAPRE and a member of the local chapter, conducted the installation assisted by Louis Howat and Frank Gillio.

Joseph Arena, newly elected president of Louisiana Chapter No. 2, is presented gavel by John N. Mariakis (left) outgoing president, as National President, Frank L. Chase approves.

Outgoing chapter president, John N. Mariakis, was presented with a token of appreciation by the membership for his spirited leadership during the term of office just completed. National President Chase also presented Mariakis with a past President's pin and reminded the members and their guests that Mariakis had been honored by being elected National second vice-president at the recent conclave in Chicago. In his report to the members of his tenure of office, Mariakis called attention to the fact that membership of Louisiana No. 2 Chapter had grown to over 400 members.

Outgoing Educational Chairman, John Funel, was given a silver cup in recognition of the outstanding programs which he had arranged for the Chapter during the past year, including plant tours, lectures on technical subjects and sponsored demonstrations. Several past presidents of Louisiana No. 2 Chapter attending the dinner meeting were recognized and honored, among them being John J. Bryner, Milton Mancuso, James J. Chaisson, William J. Williams, Addison E. Wegener, Frank L. Chase, Leo J. Vivien, Frank X. Gillio, Louis W. Howat.

Special guests were Mr. and Mrs. J. R. Thompson of Jackson, Mississippi. Thompson is Prexy of the newly established Mississippi Chapter No. 1, located at Jackson, Miss. The Jackson group, sponsored by Louisiana Chapter No. 2, was chartered during September of 1957 and President

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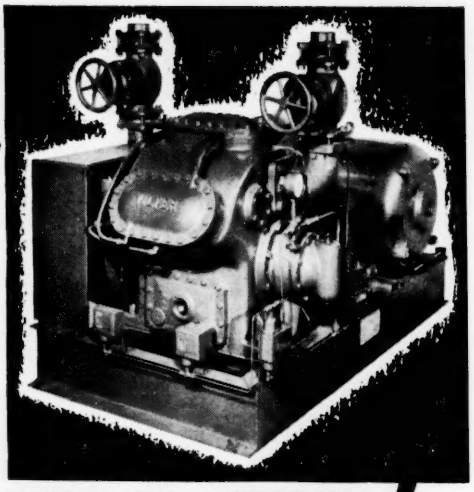

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1. Removable alloy steel cylinder sleeves that permit low cost, easy replacement. Eliminates need for oversize pistons, rings, etc., which are common in frame bored cylinders	Yes	Yes	No	No	Yes	Yes
2. A double bellows oil immersed shaft seal that prevents air or moisture from entering the system when operating below atmospheric pressure	Yes	No	No	No	No	No
3. A crankshaft double row roller bearing arrangement that allows the shaft to expand freely, thus preventing excessive thrust loads on the bearings	Yes	No	No	No	No	No
4. A statically and dynamically balanced crankshaft that assures smooth operation	Yes	Yes	Yes	Yes	—	Yes
5. Spring loaded safety heads that protect the compressor against refrigerant slugs	Yes	No	Yes	No	No	Yes
6. Removable connecting rod bearings that can be changed without also removing the connecting rod and piston assembly	Yes	No	Yes	Yes	Yes	Yes
7. Necessary to dismantle entire unit for repairs	No	No	Yes	Yes	No	No
8. Suitable for high stage or booster operation	Yes	Yes	No	No	Yes	Yes
9. Light weight aluminum pistons with upper half of piston wall having tapered thickness to conduct heat from top of piston. This prevents excessive piston expansion and reduces possibility of piston seizure	Yes	No	No	Yes	No	No
10. A separate oil filter, in addition to crankcase screen, to super-clean oil and thus reduce wear to a minimum	Yes	Yes	No	Yes	Yes	Yes

From this comparison, you know that *you get more for your money* with Vilter. It will pay you to consider Vilter for your next refrigeration or air conditioning installation.

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Thompson said that the leaders of his chapter were very pleased with the progress which was being made.

A delicious dinner was served and following the business part of the meeting members and guests, caught by the spirit of the New Orleans Mardi Gras season, danced and pranced til the wee hours of the morning to the rhythms of a "real cool" New Orleans dance orchestra.—JIM MERWIN.

Discusses Recirculation For High-Pressure Side

DETROIT—Despite cold January weather, an exceptionally large attendance of members and guests gathered at the Geo. B. Bright Chapter meeting, January 23. A discussion on the topic, Recently Designed Industrial Refrigeration Equipment Makes Old Plants New and New Plants Better, was presented by R. B. Bass, Sales Manager, J. E. Watkins Company, Chicago. Bass discussed the basic operating principles of evaporator coils and units.

Explaining various feed devices which either prevent or allow overfeeding, he pointed out disadvantages in either result; especially entrainment of liquid in the suction line coming back toward the compressors. He showed how to handle liquid in suction lines; how to prevent it from reaching the compressors. By using liquid recirculation, excess liquid can be forced back to the evaporator coils from whence it came.

Left: Proud father and member of the chapter stands by as moral support to his son being initiated into NAPRE: From l. to r.: Leonard Bedard, President, performing the ceremony, Norman E. Garant, Sr., and his son Norman E. Garant, Jr.

Bass discussed other fundamentals of operation such as how to handle oil in ammonia and halogenated refrigerant systems, and how to obtain the advantages of subcooled liquid feed under high pressure feed conditions or under low pressure feed conditions. His talk dealt primarily with

the larger industrial and commercial types of refrigeration installations, in plants such as meat packing, dairies, ice cream manufacturing, cold storage warehouses, poultry processing, skating rinks, etc. Bass illustrated his talk with slides which gave a clear, visual, understanding of the mechanics involved.

Kiefer Succumbs

Members learned with regret of the death of Richard A. Kiefer, Franklin, Michigan. He was chief engineer of Mickelberry's Food Products Co., Detroit. He left his work about 5:00 p.m. one afternoon in December in apparently good health, but succumbed to a sudden heart attack that evening about 9:00 p.m. This is the third death in the Bright Chapter this year—two from heart attacks and one by accident. On the bright side, at the Chapter Xmas party, President Bedard initiated a second generation of Garant's into NAPRE.—Leo C. Gage

South-East Penna Elects

Lancaster—Unfavorable weather conditions with several inches of snow existed on the evening of Southeastern Penna. Chapter, NAPRE, first December meeting. This, however, did not deter members who turned out in spite of the inclement weather.

S. M. Rambo

The By-Laws committee composed of Charles Golin and Norman McMullen did a splendid job of preparing same and was commended for doing an excellent job. Same were approved and adopted by unanimous vote, the required number of members being present. Nominating committee was composed of Melvin Burkholder and Paul Ament.

Following, are the duly elected chapter officers for 1958: President, S. M. Rambo, Consumers Packing Co.;

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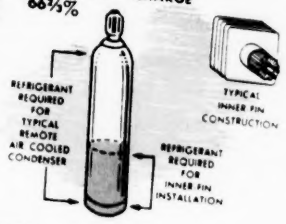
What's NEW in Remote Air Cooled Condensers? *This*

A REMOTE AIR COOLED CONDENSER THAT REQUIRES ONLY 1/3 OF THE REFRIGERANT CHARGE USED BY COMPETITIVE MODELS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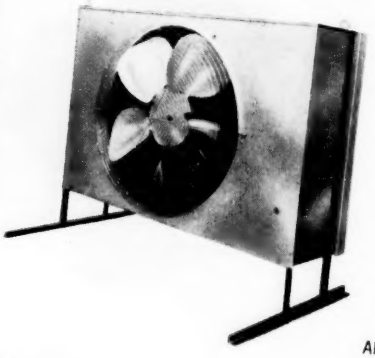
A RECENT 300 TON JOB SHOWED SAVINGS OF 1800 LBS. OF REFRIGERANT THROUGH USE OF THESE UNITS.

Yes, the Dunham-Bush 'BC' Remote Air Cooled Condensers with famous Inner-Fin construction mean savings of 67% in refrigerant charge. Additionally, they mean smaller receivers and minimum loss if the system charge is lost. In these expertly planned units, the exclusive Inner-Fin construction diminishes the internal volume of the coil while increasing the heat transfer coefficient. And higher heat transfer factors permit design of more compact units, saving valuable space in installation.

AS MUCH AS 53.5 TON CAPACITY IN ONE UNIT

The Dunham-Bush line of 'BC' Remote Air Cooled Condensers includes models in 13 sizes with capacities ranging from 2.2 tons to 53.5 tons, making possible use of a single unit for practically any job !



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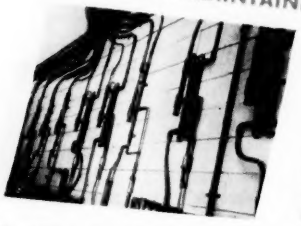
AND FOR MAINTAINING SATISFACTORY HEAD PRESSURES



at all ambients, Dunham-Bush engineers offer the 'PS' Pressure Stabilizer.

'PS' units can be mounted indoors near the compressor, facilitating the making of necessary adjustments. They are thoroughly factory tested and assembled, and require connection only to the refrigerant liquid and discharge lines. No extra piping or special loops required. Regulating valve gives smooth pressure control and eliminates wide pressure fluctuations inherent in other head control systems.

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Vice-President, Charles Golin, Lancaster Packing Co.; Director, B. K Moyer, Penn Dairies, all of Lancaster; and Director C. Lovett Wyche, Freezing Equipment Sales, York; Sergeant-at-Arms, Warren S. Tice, Lebanon Valley Brewing Co., Lebanon; and Treasurer, Melvin Burkholder, Victor J. Weaver Co., New Holland, Penna. Appointed Secretary is R. Vaughn Lefever, P. Tassia Co., York, Penna.—

Southeastern Pennsylvania Asks Utescher To Install Charter

President Rambo appointed the following committees: Educational, John Ebersole, John Cushman and Milt. Rambo. Membership, C. Lovett Wyche, Martin L. Strine and Frank L. Kain. Publicity and Public Relations, B. K. Moyer, Augustus L. Rineer and Harry W. Bott. Nominating. Clarence T. Bradley, Paul Ament and Norman McMullen.

Southeastern Penna. Chapter, weather permitting, is encouraging all its members to attend the official chartering ceremonies for New York City Chapter on March 1. There is a motive behind this action. This newest Pennsylvania Chapter in turn expects New York City to join with Philadelphia and Pittsburgh members when Erich B. Utescher, past national president, NAPRE, presents the charter to Southeastern Pennsylvania on Saturday, March 29. Even a delegation is expected from Chicago for this affair.

Deadline for becoming charter members of the Chapter had to be extended.—R. V. LEFEVER

Houston Chapter Officers

HOUSTON—New officers for the 1958 term at Houston Chapter, NAPRE, are President C. V. Parker, chief engineer, Jefferson Davis Hospital; Vice-president Larry W. Banta, air conditioning leaderman, Ethyl Corp.; Secretary-Treasurer Wm. R. Albers, chief engineer, St. Joseph Hospital. Committee chairmen appointed are Wallace Benson of the Emerson Co., educational committee; Paul Knowles, Gulf Insulating Co., membership committee.—W. R. ALBERS.

Oilers Have New Slate

TULSA—Elected early in the year for the 1958 term as Tulsa Chapter, NAPRE, officers are the following: President Melvin Coffey, Sinclair Refining Co.; 1st Vice-president Junior Knox, chief engineer, Bliss Hotel; 2nd Vice-president, Claude Wetzler, Alvin Hotel; Secretary-Treasurer Charles O. Underwood, Burt's Good Humor Ice Cream Co.; and Sergeant-at-Arms Harry Edwards, Tulsa Cold Storage. Henry Turner, Beatrice Foods, a past president of the chapter was elected director for a 3-year term. —CHARLES O. UNDERWOOD.

James Jackson, left, President of the South Florida Chief Engineers Association, congratulates three NAPRE engineers, Edmund Luster, George VanValen and Fred Lalande on receiving the first engineer's certificates issued in the State of Florida, as Frank Sasone, associate member in both associations, looks on.

Dade County Chapter Members Obtain Engineering Licenses

MIAMI – North Miami Beach Mayor Daniel D. Diefenbach presented initial city licenses recently to engineers George Van Valen, Edmond C. Luster and Fred W. Lalande. The certificates were the first of their kind issued in Florida to operating engineers. Van Valen, Luster and Lalande, members of NAPRE's Greater Dade County Chapter were presented their certificates by Mayor Diefenbach at the South Florida Annual Banquet of the Chief engineers Association, held in December in the McAllister Hotel.—CHAS. MONEYPENNY

Emerson Boland Hero of Near Disaster in Memphis

MEMPHIS—An opening night performance of the Junior League Follies, an annual amateur performance for charity in the city of Memphis, didn't go off on schedule. Attendants and performers alike were probably saved from considerable injury which would have undoubtedly resulted from panic had not NAPRE's member Emerson Boland taken quick action following a boiler flare-back.

Boland is in the Baptist hospital at Memphis, still on the critical list, with burns over 40 percent of his body. His action certainly placed him in the highest esteem of the citizens of Memphis who are already contributing to a special fund to help him meet expenses over and above usual hospitalization. In spite of his injuries and burns he had dragged himself up the stairs from the fire room to a house telephone. He alerted the building superintendent by telephone and the fire department which was promptly summoned evacuated the packed house.

Cast of the follies were unaware of the engine room catastrophe and couldn't figure out why the audience was leaving. Boland's unusual effort in seeking help without starting a panic was topped by his own action in entering an ambulance under his own power. Police, fire and medical authorities were amazed by his stamina. Most of his clothing had been blown off in the explosion, which accounted for the severity and the area of his burns.

Boilers in the Ellis Auditorium where the derangement took place, were installed 32 years ago. They had been converted to gas and it was presumed that strong winds buffeting Memphis at the time were responsible for pocketing an accumulation of gases. Boland had gone to the fire room to investigate the irratic performance of the plant. Steam and water sides of the boiler were unaffected by the flare-back. The only previous fire recorded at the Auditorium took place April 3, 1924, when fire turned the refrigerating section in the northwest corner into a charred mass of debris. It caused $40,000 damage.

New Chapter Officers

At the only January meeting of the Memphis Chapter, the following new officers took over their duties: President, Chas. G. Moore, Chief Engineer, Hotel Peabody; 1st Vice-President, W. D. Marbury, chief engineer, Hotel Chisca; 2nd Vice-president, H. M. Lentz, Sr., Supt. and Engineer, Diamond Ice Cream Co.; Secretary, Chas. A. Conley, chief engineer, Memphis Cold Storage. Alvis J. Clay, assistant chief engineer, Mid-South Refrigerated Warehouse, was appointed educational chairman. He also served as installing officer and instructed each member in his chapter duties.

In mid-February the Memphis Chapter of Producers' Council invited NAPRE members to a dinner and informational meeting sponsored by the Armstrong Cork Co. The meeting was held in the Balinese Room, Claridge Hotel. On display were all the various types of materials in thicknesses produced by Armstrong, both board material and pipe covering. A motion picture depicted proper application. Members of Tennessee Chapter No. 1, appreciated the fact that Armstrong also extended their invitation to NAPRE—CHAS. CONLEY.

Puget Sound Chapters Set Slate for '58

NORTHWEST WASHINGTON—The three chapters of NAPRE which spark plug much of the interest in the practical engineer on the part of northwest industrial refrigerating enterprises, held their elections in January and installed officers at their first meeting of the new year.

Devine Heads Olympia

New officers for Olympia chapter, NAPRE, are President Charles Devine, assistant chief engineer, Vice-president Walter W. Lohrer, maintenance engineer, Secretary Robert Jones, operating engineer, Treasurer Lyle Premo, operating and maintenance engineer, and Sgt.-at-Arms, Eugene Pratt, engineer, all with Olympia Brewing Co. John Andersen, E. M. Payne and Wayne Sanders were elected Directors.

Seattle Elects Harrison

First meeting of the year was held at the Stewart Hotel, opening with a social period and a dinner, for Washington No. 1 Chapter, Seattle, followed by the meeting. Robert Harrison, plant facilities engineer, Boeing Airplane Co., was elected president, Chalmers Elliott, refrigeration operator, Boeing Airplane Co., was elected vice-president, and William McCorkle, refrigeration design engineer for Sicks Enterprises, was elected secretary-treasurer. Committee appointments included M. E. Bell as educational chairman and Howard Penor for membership chairman. John Grainger will assist Bill Elliot as program chairman.

Bernie Terrant of Ingersoll-Rand Co., was guest speaker, discussing pumps, their selection and usage. The types discussed were horizontal and vertical split case, open and closed impeller advantages and disadvantages. Pump materials were discussed at great length. Questions from the floor were answered by Mr. Terrant in a clear and concise manner. The business meeting ended on a note that Seattle will invite other chapters in the Northwest to a Regional Conference to be held in June.

Tacoma Also Elects

Merle W. Halley, lead mechanic, Heidelberg Brewing Co., was elected president of the chapter at the first January meeting. Serving with him will be vice-president, Clarence Mase, chief engineer, Carstens Hy-Grade Packing Co. and secretary-treasurer, James R. Bennett, chief engineer, Tacoma Ice Co. Appointed educational committee chairman and chapter instructor is William Palmer, chief engineer, Medosweet Dairies. Palmer conducted an instruction on heat calculations at the January meeting. Discussions included the design of a refrigerating room, pointing out the variables involved for any particular operating characteristic. Chet Bertus, member of Seattle Chapter and a refrigeration operator at the Boeing Airplane Co., was a visitor and he extended an invitation from Seattle chapter to participate with them in the proposed Regional Conference at Seattle.—WM. MCCORKLE

Missouri Chapter Tours Food Processing Plant

ST. LOUIS—Blanton Co. was host to the St. Louis Chapter, NAPRE, on January 20. A tour of the company processing plant was the feature of the evening. Although members were briefed both in the chapter bulletin and by the company hosts, they did not realize the number of diversified operations they were to witness in the Blanton plant.

Visitors saw a complete system whereby the Blanton Co. manufactures hydrogen, from natural gas, for use in their products. They saw a 4-story deodorizer system for removing smells from various product oils. The processing section for the manufacturing or blending of various vegetable and mineral oils from a number of different raw products was quite vast. Many members did not realize the equipment required for edible oil processing, nor did they realize how extensively refrigeration plays a part in such production. Following the Blanton Company tour the members retired to the Donley Pipe & Supply Co. offices nearby where the regular chapter meeting was held and refreshments served. Although the weather was inclement the tour brought out better than 50 percent of the membership.—PETER ORLANDO.

COMING CONVENTIONS

MOUNTAIN STATES ASSOCIATION OF ICE INDUSTRIES
April 10-12, 1958
Hilton Hotel,
Albuquerque, New Mexico

ENVIRONMENTAL EQUIPMENT INSTITUTE
April 17 and 18, 1958
Hotel New Yorker, New York City
E. S. Brown, President

INSTITUTE OF ENVIRONMENTAL ENGINEERS
April 17 and 18, 1958
Hotel New Yorker, New York City
Roger Amorosi, President

CANADIAN WAREHOUSEMEN'S ASSOCIATION
May 12-15, 1958
Seigniory Club, Montebello, Quebec
H. Cecil Rhodes, Managing Director

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS
June 11-14, 1958
Chase-Park Plaza Hotels, St. Louis, Mo.
Kenneth E. Trombley, Public Relations

AMERICAN SOCIETY OF HEATING & AIR CONDITIONING ENGINEERS
June 23-25, 1958
Nicollet Hotel, Minneapolis
W. M. Vidulich, Public Relations

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
June 23-25, 1958
Leamington Hotel, Minneapolis
R. C. Cross, Executive Secretary

CANADIAN ASSOCIATION OF ICE INDUSTRIES
October 6, 7, 8, 1958
The Chantecler, Ste. Adele, Quebec
Mrs. Mildred E. Croft, Executive Secretary

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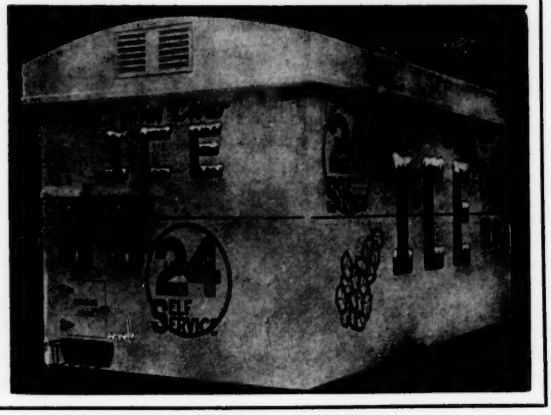
- **An increased capacity of 40% over previous models.**
- **Multi Single Line Vending of any size package or block, regardless of the type of tie.**
- **These new vendors are now made in lengths up to 20' which will vend 268 10# bags plus 132-25# blocks out of the same delivery door, (400 Sales).**
- **Up to 5 various sizes of blocks or bags can be vended from this one vendor.**
- **Radical invention, trouble free, more storage space by design, lower operational cost.**

NEW LOW COST 6' x 8' station vends 110-10# packages, or the "Junior", 3' x 7' station vends 90-10# packages using the new multi screw vendor.

ILLUSTRATED
9' x 16' Station vends 168-10# bags and 86-25# block.

K. G. BROWN MFG. CO., INC., MATTITUCK, N. Y.



Book Review

DRYING AND DEHYDRATION OF FOODS. Second edition. By Harry W. von-Loesecke. Published by Reinhold Publishing Corporation, New York. Illustrated. 300 pages. Price $7.50. For sale by Nickerson & Collins Co., Chicago, Ill.

This new edition, completely revised, reflects all the rapid strides made during the last decade in the field of food dehydration. It provides the facts necessary for successful operation of dehydration projects, both large and small. It stresses specific details, such as moisture content, time and temperature of blanching, yield to be expected, trimming losses and similar problems for all types of fruits, vegetables, meats and fish, as well as a complete chapter on dairy products.

The construction and operation of the most modern types of dehydration machinery and equipment, including drum and tunnel dryers, spray dryers and vacuum drying cabinets, are described at length. It will be of interest and value to food technologists, industrial engineers, chemists, agriculturalists, public health officials—to everyone concerned with the processing and handling of food products.

Harry W. von Loesecke's knowledge and long experience in the field of food dehydration qualifies him as one of the country's top experts on the subject. He is author or co-author of some 60 papers dealing with food research, three books on food processing, and is a contributor to textbooks and encyclopedias pertaining to food processing and agricultural chemistry.

DEATHS

Chase Blum

CHASE BLUM, 66 year old inventor, and owner of the Chase Industrial Refrigerator, Equipment and Engineering Company, died Monday, February 3, 1958, at Cincinnati, Ohio. Mr. Blum born in Gloversville, N. Y., came to Cincinnati in 1933 to establish his company in the manufacture of special hardware for industrial refrigerator doors.

Beginning with one employee he developed his company into one of the largest specialty concerns, with his invention of the stay-tight double lock door and accompanying gaskets, for refrigerators. The Chase company services the dairies, meat packers, frozen foods users, rather than the refrigerator manufacturer.

PATRICK H. GOOGIN who organized the Independent Ice Company at Salt Lake City, Utah, died February 16 after a long illness. He was 84. Mr. Googin came to Salt Lake City in 1902 from Indiana as assistant manager of the Salt Lake Ice Co. He organized the Independent Ice Co. in 1910. He was a former Salt Lake City Commissioner, state legislator and civic and business leader.

JOHN T. LANGSTON, JR., Darlington, S. C., who for many years owned and operated the Langston Ice & Fuel Co., died January 20 after an illness of several months. He was 56. For many years he was active as a business and civic leader in Darlington.

CHARLES WESLEY WILSON, Dallas, Tex., formerly a stationary engineer for Southland Ice Co. died January 25, following a series of heart attacks. He had retired in 1934.

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For temperatures minus 60° F. to 40° F.
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Can also be used with Brine and anti-freeze solutions.
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LITTLE GIANT

DEPENDABLE ICE BREAKERS BY MICRON, INC., BETTENDORF, IOWA

Sheaffer New Secretary Armstrong Cork Company

Albert H. Sheafer

ALBERT H SHEAFFER, manager of the Armstrong Cork Company general legal department, was elected secretary of the company at a meeting of the board of directors. Mr. Sheaffer has been serving as acting secretary of the company since the retirement on October 27 of Keith Powlison, formerly vice-president and secretary. He will continue to manage the company's general legal department. He joined Armstrong in a clerical capacity in the patent Department early in 1929. He continued his studies leading to a law degree, which he received in 1939 from the Washington College of Law. He was admitted to the Pennsylvania Bar in 1945.

Mr. Sheaffer was appointed assistant manager of the legal department in 1945 and was elected an assistant secretary in 1954. He was named manager of the general legal department last October. He is a member of the Lancaster, Pa., and American Bar Associations and of the American Judicature Society.

York Appointments

A NUMBER of appointments have been announced by York Corporation, subsidiary of Borg Warner.

THEODORE Y. DAVIS has been named manager of the Middle Atlantic District. Mr. Davis in his new assignment will supervise all York activities in Pennsylvania, Maryland, Delaware, Virginia, and southern New Jersey.

CHARLES P. STRICKLAND, JR., has been named manager of the Southwest District. Mr. Strickland will supervise York activities in the area comprised of Louisiana, Texas, and portions of Alabama, Arkansas, Mississippi, and New Mexico. His headquarters will be in Houston, Texas.

CHRISTIAN J. SCHURMAN has been named manager of the Pacific district. Mr. Schurman will make his headquarters at the Los Angeles office of the air conditioning and refrigeration manufacturing firm.

FRED C. WOOD has been named manager of the Central District. In his new assignment, Mr. Wood will supervise the sale of engineered refrigeration and air conditioning equipment in the states of Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, and Wisconsin.

WINSTON W. SALMOND has been named manager of the Southern District. In his new position, Mr. Salmond will supervise York activities in the states of Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee.

E. JOHN BERLET, JR., has been named manager of the North Atlantic District. Mr. Berlet will supervise York activities in the area comprised of New York, Connecticut, Massachusetts, Rhode Island, Vermont, New Hampshire, Maine, and northern New Jersey.

MARVIN M. CROUT has been named service manager of Engineered Machinery. Mr. Crout has served for the past 15 years as industrial manager of the air conditioning and refrigeration manufacturing firm's Southern District with headquarters in Atlanta. He will relocate in the York executive offices at York, Pa.

WILBUR S. MILLER has been named sales development manager. Until his new assignment, Mr. Miller served as manager of the Southwest District, supervising activities of the air conditioning and refrigeration equipment firm in the states of Texas and Louisiana, as well as portions of Alabama, Arkansas, Mississippi and New Mexico.

CHARLES W. EGBERT has been named manager of applications. A native of Montclair, N. J. Mr. Egbert joined the York Corporation in 1936 following his graduation from Cornell University where he received his Mechanical Engineering degree.

JOHN L. ROTH has been named manager of associate sales. In his new position, Mr. Roth will direct the activities of York Associates, the company's franchised representatives, in the sale of engineered machinery throughout the United States.

American Water Softener Elects New Officers

AMERICAN Water Softener Co., Inc., of Philadelphia, announces the election of Alfred G. Scattergood, president; Alfred G. Zeigler, vice-president and general manager; Martin H. Love, Jr., vice-president, production and procurement; George S. Garrett, treasurer; and Richardson Blair, secretary. American Water Softener Company, was founded in 1902 by Arthur S. Garrett and Thomas Scattergood. Alfred G. Scattergood, the new president, has been on the sales engineering staff of the company for many years and has a chemical engineering background, having spent much of his early life as a research chemist.

Recold Appointments

AS a part of the Recold Corporation's expansion program, Harold A. Halls has been promoted to the position of Manager of Refrigeration Products, announces H. T. (Hy) Jarvis, president of Recold, Los Angeles, Calif. Associated with Recold since 1953, Mr. Halls will continue his present duties as national refrigeration service manager but in his new capacity, he will take on added responsibility in management decisions on refrigeration products and policies explained Mr. Jarvis.

A veteran of 32 years in the refrigeration and air-conditioning industry, Mr. Halls worked with Servel, Inc., and Refrigeration Service, Inc., prior to joining Recold in 1953. He is a member of the American Society of Refrigeration Engineers, National Association of Prac-

Sherman Singer

Harold A. Halls

tical Refrigeration Engineers, and Refrigeration Service Engineers Society.

In conjunction with the expansion program underway, Sherman Singer has been promoted to manager of air conditioning products. Mr. Singer, who has been in charge of Recold's catalog engineering for three years, will continue to handle his duties on catalogs and pricing but will take a more active responsibility in management decisions on air conditioning products. Prior to joining Recold in 1954, he was associated with Drayer Hanson, Inc. as assistant sales manager and before that he served in the sales department at U. S. Airco, Inc. for two years.

Engineer's Application Manual Bulletin

A NEW Engineer's Application Manual Bulletin 9-10 has been issued by The Refrigeration Specialties Company, Chicago, Ill. The Bulletin describes control valve combinations for automatic hot gas defrosting of various types of flooded and direct expansion ammonia evaporators. Selection and capacity tables are given for special suction and hot gas solenoid valves as well as defrosting relief regulators.

Masterson Joins Patterson

J. V. Masterman

J. V. MASTERMAN, has announced his resignation from the York Division of Borg-Warner to accept a position with the consulting firm of V. C. Patterson & Associates, Inc., York, Pa., engineering specialists in refrigeration, insulation and air conditioning. He had been employed by the York Corporation in their Boston, Brooklyn, Philadelphia, and York offices since 1926, where he held positions of factory branch engineer, special contract design engineer, and special contract project engineer on major industrial refrigeration and air conditioning projects. He also has designed many of the test facilities for our Armed Forces.

Mr. Masterman's long association with the industry on basic plant design and application enabled him to contribute much in the refrigeration fields of brewery, candy manufacturing, bakery, dairy, chemical, marine as well as comfort and industrial air conditioning. His last assignment with Borg-Warner was the design of the largest heat pump air conditioning plant yet undertaken. On January 17, accompanied by his wife, he left the states for Tehran, Iran, and Rome, Italy, where his first assignment in his newly accepted position is that of special engineering consulting for a proposed meat packing plant in Tehran. The firm of V. C. Patterson & Associates, Inc. have had similar projects abroad, in Sweden and England, in connection with food processing and the design of cold storage warehouses.

VAN RENSSELAER
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COMPLETE PLANT DESIGNS
INCLUDING BUILDING AND
EQUIPMENT

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Classified Advertising

All classified advertisements are payable in advance. Except for Positions and Help Wanted classifications, this section is reserved exclusively for USED equipment.

RATES: 20c per word; minimum 25 words. $2.00 per line for bold face headings; $15.00 per inch for line listings.

USED EQUIPMENT—wanted & for sale

FOR QUICK SALE

Complete 70 ton ice plant, 12 can pull, for one man operation, maintained in top condition. Can be seen in Operation. Owner wishes to retire. Asks $12,000. f.o.b. middlewest, this includes dismantling and loading. Plant is near water. Can be loaded on barge for cheap freight. Born Company, 80 E. Jackson Blvd. Chicago 4, Ill. WAbash 2-3299.

FOR SALE
RED TOP BREWERY — CINCINNATI

All equipment for sale, plant closed November. Complete modern equipment, including refrigeration equipment, condensers, compressors, ammonia pipe, etc. Write for illustrated booklet. Chas. S. Jacobowitz Corp., 3080 Main St., Buffalo 14, N. Y.

FOR SALE — Complete 15 ton Frick Ice Plant, erected new 1947. Good condition; $6,000.00 f.o.b. cars North Carolina. Born Co., 80 East Jackson Blvd., Chicago 4, Ill. WAbash 2-3299

FOR SALE
FORT PITT BREWERY — PITTSBURGH

Complete modern 750,000 bbl. annual cap. brewery. All equipment being sold piecemeal including refrigeration equipment, condensers, compressors, ammonia pipe, etc. Write for illustrated booklet. Chas. S. Jacobowitz Corp., 3080 Main St., Buffalo 14, N. Y.

WANTED TO BUY — Good used York, Vilter or Frick ice machines, size 6x6 to 10x10; also Blast Brine spray units. Hill Packing Co., P.O. Box 148, Topeka, Kansas.

FOR SALE — Refrigeration equipment; ice equipment; new, used. Advise us your needs. Use "QUICKSEAL" — stops brine tank leaks; easy, efficient, economical. Born Company, 80 East Jackson Boulevard, Chicago 4, Illinois. WAbash 2-3299

FOR SALE — Amonnia & "Freon" Equipment. One 13¼x9 Frick booster compressor, syn. motor; three 5¾x4 Frick booster compressors, V-belt; one 5x5 Frick ammonia compressor, V-belt; 1- 9x9 Frick ammonia compressor, V-belt; 1- 8x8 Frick ammonia compressor, V-belt; 1- 30 h.p. Chrysler "Freon" condensing unit; 2- 75 ton S&T Acme "Freon" condenser; 1- 100 ton S&T Frick "Freon" condenser; 1- 36"x16' Frick ammonia brine cooler. All in excellent condition.
R. H. Bozman & Bros.,
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FOR SALE

10x10 York Model D8 125 h.p.
9x9 York duplex Model D8 360 r.p.m. 200 h.p.
7½x7½ York w/V-belt drive 50 h.p.
(2) 6x6 Yorks V-belt drive 25 h.p.
6 cylinder 5¼x4¼ York F-12
4 cylinder Carrier type 7G8 60 h.p.
300 h.p. Westinghouse starter, 4160 volts (New)
100 h.p. 1200 r.p.m. GE motor w/starter.

JOHN F. CARSON
A & Venango Sts., Philadelphia 34, Pa.
GArfield 6-2221

PERFORMANCE-PROVED — New Ball Valve discharge and suction valves, pictured on page 20 of this issue, improve the performance of any compressor, old or new.

FOR SALE—One 8 x 8 and one 6 x 6 high speed ammonia compressors. The Gus A. Regnier Refrigerating Engineering Co., P. O. Box 1093 New Haven, Conn.

FOR SALE — 4x4 self-contained York. 4x4 Frick. 8x8 York. Valves up to 2", one-half price. New ammonia mask, $12.00. Write E. Niebling, 1546 St.Clair, Mt. Healthy, Cincinnati 31, Ohio.

FOR SALE — GE Freon 12 condensing unit type CM124F with 40 h.p. motor. Two 2500 gal. water tanks 125# pressure, horizontal, with saddles. Stone Conveyor Co., Inc. Honeoye, N. Y.

FOR SALE — 12½ x 14½ York ammonia compressor, without motor — any reasonable price accepted. International UD 14 Diesel electric generating set—like new. L. P. Ilgen, Brook Park, Lewisburg, Penna.

FOR SALE—AMMONIA

4—10"x10" 4-cyl. York duplex D. C. to 225 h.p. motor.
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1—9"x9" 2-cyl. York D. C. to 75 h.p. motor.
4—9"x9" 2 cyl. Frick compressors.
1—7¾"x5" Frick booster.
2—7½"x7½" 2-cyl. York compressors.
1—5¼"x4¼" 6cyl. V/W York booster compressor.
1—5"x5" 2-cyl. York compressor.
1—3"x3", 1—4"x4", 2—5"x5 condensing units.
11"x22"x47"—11"x22"x51 ice cans.
From 20 to 100 ton ice plants, York & Frick.

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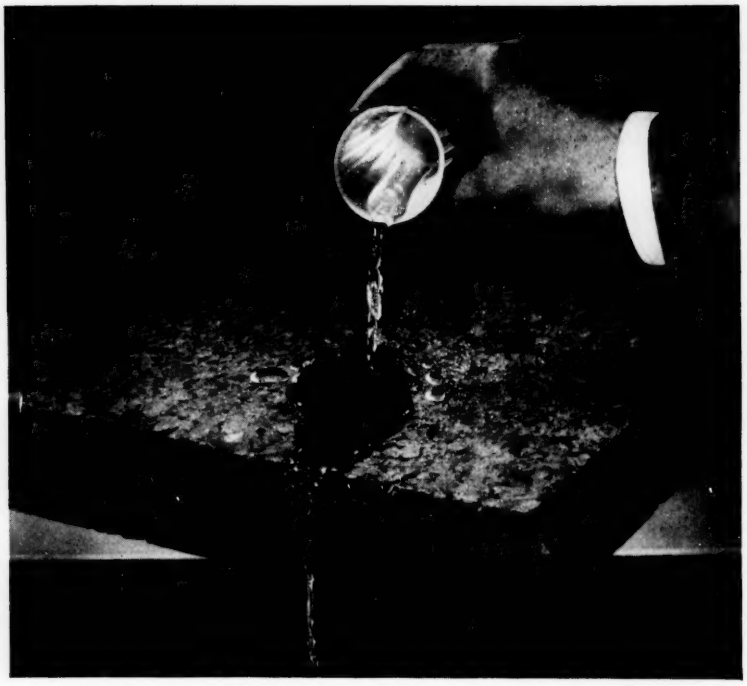

Why United's patented process results in corkboard of lower moisture absorption

Cork in its natural state is well known and highly regarded for its excellent insulating and moisture resistant characteristics. However, by an exclusive blocked-baked patented process that uses internal and external heat to release the natural resins in the cork, United BB Corkboard becomes substantially more moisture resistant.

Further, United Corkboard is all cork . . . with no filler added. It's flexible too . . . fits tight . . . stays tight . . . installs easier and stays on the job! Most important, there is adequate flexibility to conform to minor wall irregularities and absorbs stresses.

The next time you have a need for low temperature insulation investigate the unique combination of benefits only "patented process" United Corkboard can provide.

Write today for specifications and helpful installation data. No obligation.

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UNITED CORK COMPANIES
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ENGINEERING AND INSTALLATION SERVICE — to meet your individual requirement . . . insure the most effective use and provide proper installation, United maintains fifteen branches throughout the country, staffed with experienced engineers and installation crews. For the one nearest you simply write to our Kearny address.

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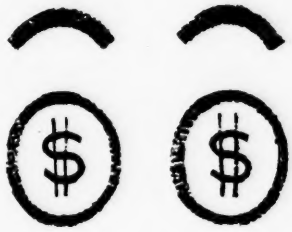

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Later—Non-condensable gases formed, head pressure up . . .

Still later—Too much moisture, float valves frozen . . .

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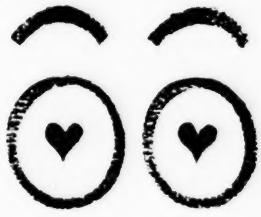

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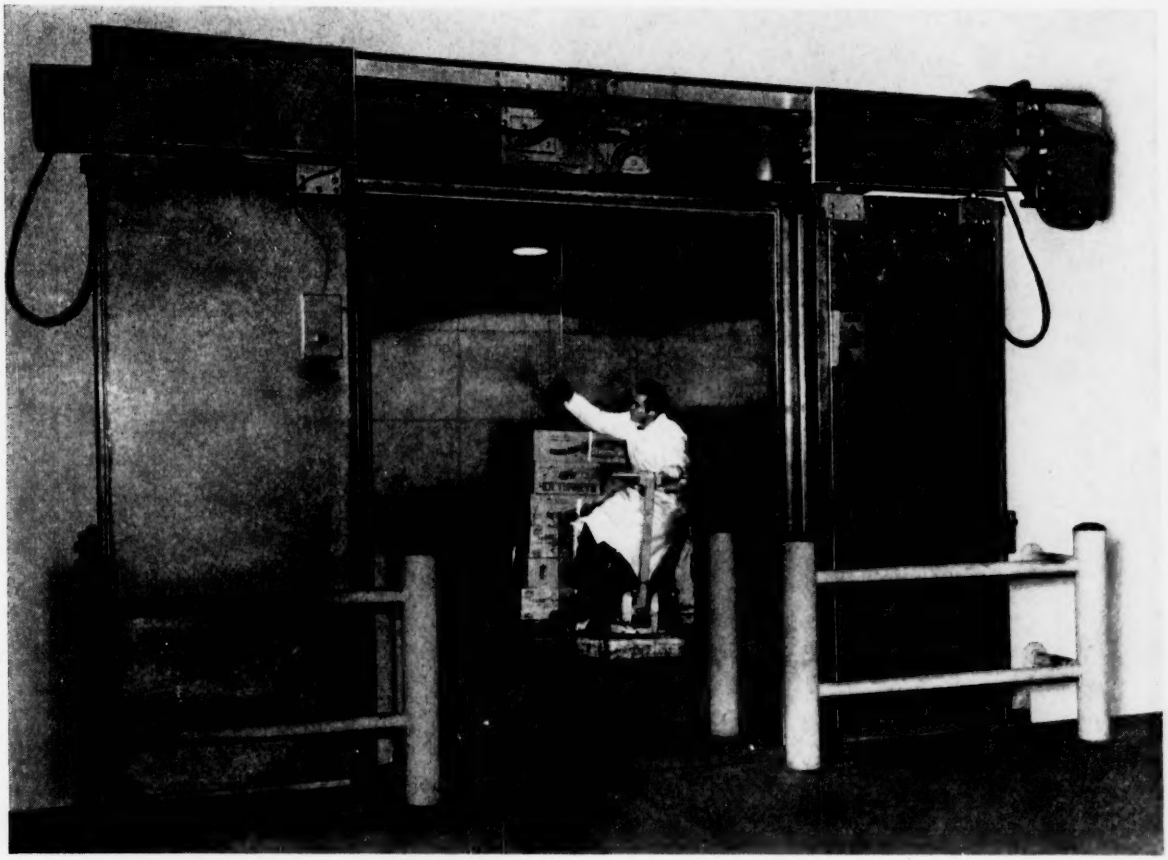
Such consistent purity, plus a dependable delivery service from 163 stock points and 8 bulk stations, makes Armour your one best source for trouble-free ammonia every time. For further information, sulfur tapers and test papers, write us on your company letterhead.

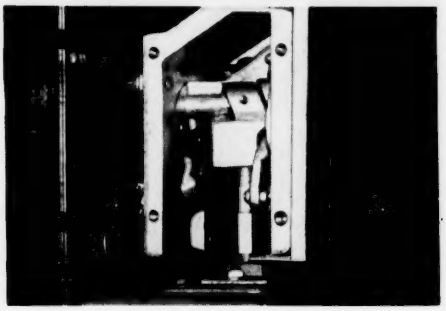
ARMOUR AMMONIA DIVISION

1353 West 31st Street • Chicago 9, Illinois

New Jamison *Electroglide** Power Door speeds traffic, saves refrigeration *automatically!*



Electroglide offers famous Jamison Cold Storage Door quality and performance plus a completely new design for power operation. Both bi-parting and single leaf Electroglides are available to meet all job requirements.



EXCLUSIVE CAMLOK COMPRESSION SEAL—Jamison Camlok cams doors "in" against frame and "down" against floor at all points.

These other exclusive features mean dependable, smooth operation.

SHOCK ABSORBER CHAIN LINK—reduces wear and tear

SPRING LOADED SUSPENSION—minimizes power requirements

IMPROVED SAFETY EDGE—sensitive full height and full travel of door

SEALED-IN-OIL REDUCTION GEAR—trouble-free operation, minimum maintenance

High volume traffic can now speed on its way in busy cooler and freezer operations with minimum loss of refrigeration. Electroglide is specifically designed to accelerate truck movement with its instant automatic opening and closing.

Rapid smooth opening—Spring suspension helps doors open easily and smoothly. Doors move "out" and "up", riding on level tracks with gaskets clear of sill and frame.

Electroglide is made for both cooler and freezer use. Write today for new Electroglide bulletin to Jamison Cold Storage Door Co., Hagerstown, Md.

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